THE FOUNDRY

For October

Employment Rests On Needed Replacements

DESPITE continued high unemployment figures, a shortage of manpower is at hand. This was foreseen. The crisis impending was dinned at the foundry industry through these pages for the past two years.

Good superintendents and foremen, as indicated by inquiries, are unobtainable. Managers and technical men in the higher brackets are unavailable. Rumors of enticement for molders, coremakers and other skilled workmen testify to the condition in foundry labor. Apprentices from part-time training schools may be had only by application through a waiting list.

Some foundries have been farsighted. They have maintained their own men or scoured those varied lines where many good foundrymen sought shelter from the depression storms. New evidence of interest in apprentice and more advanced training is found among those previously unconverted.

Sales of machinery to multiply labor doubtless constitute the backbone of recent equipment activity. However, the bulk of this plant improvement is among production shops. Jobbing foundries still find financing a problem. With the harvest at hand they can buy only scythes, when they need mowers, or reapers when they require combines. Foundries were bled white by the depression. Those that survived did so by grace of reserves. They can buy machinery today only on credit. They can put common labor to work, if they can get trained foremen and needed equipment; but will they be able to replace obsolete machinery or maintain employment in event of even a minor recession?

After a Breathing Spell?

THE system by which American industry grew provided a margin for new equipment as better machines were offered. It provided for cash reserves to pay wages over slack periods. It was based upon the honest effort to supply more and better goods for lower prices.

The hampering effects of restrictive laws and the threat of more to come give real concern to anyone in business today.

Will foundrymen find their effort to get sufficient men blocked by high wages to shovel leaners? Will effort be made to regiment industry along lines of smaller output at higher prices under a new blue buzzard? Can Washington force the continued dribble of dividends at the expense of safe corporation reserves? Will competition with industry be extended to put tax supported government foundries in the jobbing business? Such has been done in utilities, furniture, mattresses and whatnot?

Perhaps this is not such a far step. It means only expanding what already exists in shipyards. On other government work, it requires only a tightening of present hour, rate and penalty provisions of public contracts administered under recent departmental rulings.

Milwaukee in 1937

SELECTION of Milwaukee for the convention and exhibition of the American Foundrymen's association in May, 1937, promises new impetus to the industry. The Milwaukee area embraces many leading plants making practically every line of cast products. The city has led in training, in technical progress and in good housekeeping, all important items in the industry's present day problems. There in 1918, the foundry industry dedicated its united effort to war service. The record achieved is familiar to those who recall the direct contribution in castings badly needed for arms, ammunition, machines and ships. The lessons of Milwaukee foundry methods, the technical papers and discussions on war materials and the exhibition played a prominent part in the fine record of the industry in war time. Equally potent is the opportunity given the industry by the A.F.A. in 1937.

The Foundry Has a New Dress

READERS will note a striking change in the appearance of this issue of THE FOUNDRY. The entire editorial section has been printed from a new type face only recently cut. A comparison with previous issues will show that this face may be read much more easily.

Editor

Fig. 1 (Above)—Pouring is aided by an overhead crane, good light and equipment arrangement. Fig. 2 (Left)—Jolt-squeeze stripper machines are located between conveyor lines

Producing Auto Brake Drum Castings

By R. CAMPBELL WELLMAN

BIPLANES of ten years ago would fall far short of the speed and efficiency now demanded for transporting mail and passengers. In the same way, slow-speed molding would fall short of today's necessity for maximum production of automotive work in minimum time. This trend and change is exemplified in the methods and equipment recently adopted for producing automobile brake drums at the plant of the Ferro Machine & Foundry Co., Cleveland.

By using modern methods to meet present day demands, the company maintains production of approximately 4000 brake drum castings, consisting of a combination steel plate and cast iron rim, in an 8 hour shift. A 200-foot, intermittent, flatplate conveyor, built by the Jeffrey Mfg. Co., Columbus, O., powered by a 5-horsepower motor and traveling at a rate of 22 feet per minute is used in carrying the molds from the machines to the pouring and shakeout stations. Each flat plate on this conveyor has sufficient room for two complete molds with one casting in each mold.

A battery of five cope machines and five drag machines of the combination jolt-squeezer stripper type, illustrated in Fig. 2, and built by SPO Inc., Cleveland, is used in the production of the molds. These machines are arranged in a straight line through the middle of the surrounding conveyor system, and are spaced adequately to allow ample room for handling the molds. The operating crew for the unit includes 27 men distributed as follows: 10 on the molding machines, 6 helpers, 2 checking the molds before pouring, 4 handling the ladles and 5 at the shakeout station. Each man has a specific job and, as may be seen in Fig. 3, the entire facilities for production of these brake drums have been arranged to eliminate all undue confusion or congestion.

Molds Made in Steel Flasks

Molds for single castings are made in steel flasks built by the Fort Pitt Steel Casting Co., McKeesport, Pa. Drags are rammed first in approximately 40 seconds on the machines and placed by the molder and his helper on the conveyor line. The steel plate which becomes a part of the casting, is placed on the outlying flange approximately halfway down in the drag, as shown on the left of Fig. 4. The drag travels about 10 feet on the conveyor, as is shown in Fig. 1, to the cope machines next in the sequence. The cope, illustrated on the right of Fig. 4, having been rammed in similar manner to the drag, is placed in position on the drag and steel plate. An accurate check of each molder's production is kept on a blackboard beside the conveyor line. This includes the number of hours worked, drag and cope molds produced per hour and the total production of the entire unit for each day of the week.

A thin steel plate approximately 10 inches in diameter is inserted in the drag mold, in the space shown in Fig. 4, as the mold travels down the conveyor line toward the cope machines. These plates are kept in convenient stacks or piles immediately adjacent to the conveyor line and after being washed, are placed in the mold to form the back part of the casting. The workman assigned to that job carefully places the individual plate in the mold with a hook. This plate is perforated by holes spaced about ½-inch apart and is constructed according to the job for which it will be used. That is, it may be dovetailed, flat, or it may have a ½ x ¾-inch flange for connection with the cast iron band. The latter plate carries a series of ten 3/32 x ½-inch notches spaced 2 inches apart which aid in locking the plate and rim together firmly. For some castings, a small, specially constructed core is placed in a notch in the plate to act as a peephole and facilitate proper pouring of the iron. The cope having been placed over the drag with this plate inserted, the mold is ready for pouring.

Metal Must Flow Evenly

Hot metal is introduced through a single sprue and numerous gates in the drag. This is necessary to maintain a uniform distribution of the metal. Due to the shape of the brake drum casting and the steel plate, metal must flow evenly to eliminate cracking and chilling. To accomplish this, the metal is poured through the single sprue in the cope into the circular runner which feeds into the gates in the drag. This runner is approximately ¾-inch high, 1-inch wide at the bottom and ⅜-inch wide at the top, with a full diameter of about 1½ inches, tapering toward the end to ½-inch.

This will decrease the possibility of uneven cooling of the metal during the operation and assures against clogging or sticking. If this (*Please turn to page* 72)

Fig. 3—All production facilities have been arranged to eliminate congestion around conveyor and machines

A Business Man's Soliloquy

By RAYMOND L. COLLIER

Secretary, Steel Founders' Society of America, Cleveland

I AM firmly convinced that there is need for a strong, active national trade association in my industry—in any industry.

¶I can understand how the efforts of a minority to establish sound business practices would be ineffectual if the majority choose to go in all different directions—many diametrically opposite.

¶I can see why statistical information contributed by 10% of an industry would be almost valueless, and why 90% participation would make all the difference between a weak showing and a bull's eye for the trade association.

¶I am sure friendships acquired in the course of co-operative trade association work are worth while and can be mutually helpful.

¶I am *sold* on co-operative organization as the most economical and effective method of dealing with many industry problems which cannot be solved by individual companies acting alone.

¶I believe the first big job of any industry, seeking a solution of problems too broad to be attained by individual action, to be that of joining together into a strong, efficient trade association.

¶I realize that such an organization cannot speak authoritatively for the industry unless it has the moral and financial backing of a preponderant majority of the best-thinking minds in the business.

¶I have observed that the greater the number of individual business units in the industry, the more difficult it is to build a representative organization.

¶I am aware that no worth while service can be undertaken by a trade association until the question of membership is out of the way.

¶I know the trade association manager is *behind the eight ball* as long as the major portion of his time has to be devoted to membership building.

¶I appreciate the fact that no industry can expect its trade *association manager to spend nine-tenths* of his time soliciting memberships which slip away because only *one tenth* of his time can be devoted to constructive work.

¶I conceive this question of membership building as a direct challenge to me and as a task which I and everyone else in the business should accept as primarily our responsibility.

¶I fully understand that I cannot expect, upon joining such an organization, to immediately receive amazing benefits without any effort on my part.

¶I am certain it is a mistake to join a trade association with the idea of sticking for a relatively short, limited period, to give it an opportunity to demonstrate to *me* that it can be valuable to me in the conduct of my business.

¶I feel positive on the other hand, that the correct approach is to join with the idea that I will stand by the organization indefinitely, meanwhile exerting my full influence to indicate to others in the business that our collective future will be brighter if we all join, and through pooling of resources, make possible the financing of a worth while program that will be of real benefit.

¶I conclude that successful trade association work is not self-starting—that it can come about only through the *sustained* enthusiasm of a *united* industry which must express itself first through joining the common organization and then helping to make the program adopted function effectively.

¶I do not think of trade association work as a miraculous thing whose magic will perpetually insure my company, if a member, against red ink.

¶I am sure it is illogical to expect worthwhile results from trade association work unless I support the program by contributing financially *and* by giving freely of my personal time, thought and counsel to the work in hand.

¶I am positive that the best program ever developed for cooperative industry activity will be unavailing without the enthusiastic support of the industry behind the plan.

¶I do not propose to participate in the better conditions brought about by the trade association in my field without doing my share.

¶I do not expect, I do not want, a free ride—at the other fellows' expense.

¶I am persuaded that in the perilous, uncertain period which appears to lie ahead for American business that it behooves all units in all industries to band themselves together with the strongest possible ties for mutual counsel and support.

¶I shall join my association and work—work hard, along with my fellow members, toward our common objectives.

¶I shall do all in my power to build a strong, efficient trade association for my industry.

¶Then, after the membership has been built to satisfactory proportions and the program adopted is well under way, should I find that the association's work falls short of my expectations, I may reasonably ask "Why?" But I will direct the question to the man whom I see in my mirror.

Milwaukee auditorium, scene of the 1937 A. F. A. convention and exposition

A. F. A. Selects Milwaukee for Convention and Exposition

MILWAUKEE, one of the foremost foundry centers in the United States, has been selected for the forty-first annual convention and exposition of the American Foundrymen's association, to be held during the week of May 2, 1937. The meetings and display of equipment and supplies will be staged in the Milwaukee auditorium.

The board of directors of the A.F.A., in selecting Milwaukee for the 1937 gathering of the foundry industry, gave recognition to the progressive Milwaukee chapter. The interest and activity of the foundrymen of that section has placed Wisconsin in high rank in technical attendance and in handling the practical problems of foundry practice, apprentice training, cost, safety and hygiene. Outstanding plants, making all classes of castings, will be available for inspection by those attending the annual gathering of foundrymen. This feature has been found most attractive at recent conventions.

Milwaukee is eminently suited for the activities planned, and is accessible by rail, automobile, air and water transportation. Hotel accommodations have been greatly expanded since the last previous American Foundrymen's association convention held in that city in 1924. The auditorium, often cited as a model of such structures, and located within walking distance of the business and hotel section of the city, has full facilities for technical and committee meetings and for exhibits of equipment and supplies used in the foundry industry. This well equipped hall was the scene of the 1918 and the 1924 conventions of the association.

Feature Recent Developments

Shaping the program and exhibition to meet the present day needs of the industry, special attention will be given to new technical and mechanical developments. Papers on all phases of foundry practice and on management problems will be offered, with special attention being given to the medical and legislative aspects of safety and hygiene in the foundry. In addition, papers are scheduled on the use of safety shoes, leggings, goggles and respiratory protective devices and on maintenance of equipment. This part of the problem of foundry management today, will be found supplemented by a special section in the exhibition devoted to protective equipment. Officers of the association now are preparing the technical program, which will include formal meetings for the presentation of papers, shop courses and round table discussions.

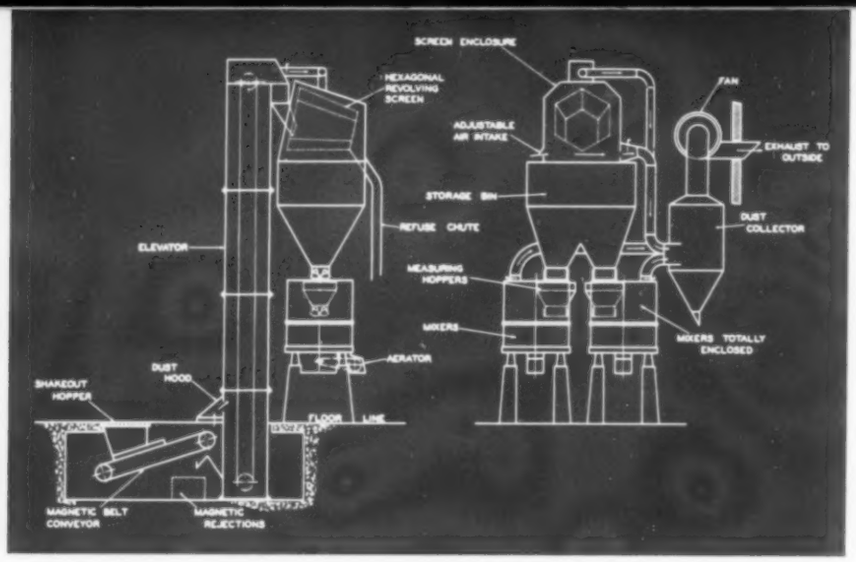


Fig. 1 — Diagrammatic sketch of sand reclaiming, conditioning and control unit

Reclaim and Prepare Sand

By LESTER B. KNIGHT JR.

Vice President, National Engineering Co., Chicago

This article is from the annual exchange paper of the American Foundrymen's association to the annual meeting of the French Foundry Technical association held in 1936

SAND reclamation and reconditioning is closely allied to sand control. Without sand control most comprehensive programs of sand reclamation will prove unsatisfactory. In the past 10 years many improvements have been made in equipment for reclaiming, conditioning and controlling foundry sand. Sand control is a large and important subject and many papers have been written on the various phases. The present article deals principally with equipment operated in the field for reclaiming and conditioning sand in the foundry.

Sand Condition Is Important

Foundrymen should realize the importance of a study of sand conditions in their foundries, effect of these conditions on the quality of their product and the opportunity this phase of their operations presents for improving quality and reducing manufacturing cost. Sand surveys conducted by the author in many different classes of foundries during the past few years have shown almost invariably where the causes of scrap loss are classified, that the sand is credited with from 40 to 60 per cent of the daily foundry loss. If this classification of loss is correct, a well rounded sand condition and control program should reduce materially these losses attributed to the sand.

Equipment for handling, conditioning and reclaiming sand should provide means for controlling the most important variables. Assuming that the grain structure of the sand is suitable for the class of castings, these variables include: Permeability, bond strength, moisture and inert fines. These variables are interrelated and each affects the other properties of any given sand. The question naturally arises how and the limits to which these variables should be controlled.

Permeability should be sufficiently high to allow free passage for the gases. Sand that is too open may result in rough castings or metal penetration. Sand that is too close may cause scabs, blows or gas holes. Allowable limits of permeability for a given class of castings must be determined empirically and by observing results after the castings are cleaned.

Excess bond or moisture causes a majority of sand defects. Satisfactory molding sand, natural or synthetic has the minimum bond and moisture required for workability. It is sufficiently workable to secure a clean impression of the pattern, to allow finishing and closing the mold and to prevent cuts, swells, washes, scabs, etc. Excess bond, or moisture or both results in scabs, excessive burning on, rough castings, blowholes, etc., leading to excessive losses and high cleaning cost.

Batch Type Mixer Used

It is extremely essential that the bond and moisture be distributed uniformly in the sand, to have each grain of sand uniformly coated with a film of clay and tempered with minimum moisture. The batch type muller is used widely for tempering and bonding sands as it is claimed that the mulling action thoroughly coats each grain of sand and develops the maximum plasticity of the clay with a minimum of moisture. Hence a minimum of clay or bond and moisture is required for workability.

Proper sand conditioning and control will not correct inherent defects in casting design, methods of molding, pouring, gating or the metal itself. However, after design, pattern equipment, etc., have been developed properly, the sand into which the metal is

poured is one of the most important variables which affect the production of high quality castings.

Each time metal is cast in sand a certain amount of clay or bond is dehydrated or partially dehydrated. Some of the sea coal is burned to ash. Some of the silica grains are fractured. This fine material is inert, has no bonding quality, decreases permeability, causes rough, dirty castings with excessive burning on of the sand. In some cases these fines actually give false strength to the sand which, when metal is poured, causes washes and scabs on the castings. Removal of fines is an extremely important factor.

Aid in Controlling Permeability

Removal and control of the fines will aid greatly in controlling permeability. Tests have proved that the removal of 2 to 3 per cent of fines from a given sand will result in a much greater increase in permeability than the addition of 30 per cent new, coarse silica sand. A recent test indicated that 15 per cent addition of coarse silica sand produced no increase in permeability.

The up to date modern sand reclamation, reconditioning and control unit provides for: 1—Cleaning and screening the sand to remove metallic and other refuse. 2—Reconditioning or rebonding the used sand in the batch type muller so that a minimum of new sand or bond and moisture is required for workability. 3—Properly aerating the sand after it has been conditioned in the muller. Aeration after proper conditioning increases the flowability of the sand and thus helps to obtain smooth surface castings with sharp edges and maintained closely to tolerances and weight allowances. 4—Complete housing of and exhausting air from the equipment handling the shakeout sand with damper control on the exhaust outlets to control closely the amount of inert fines in the sand. This not only allows simple control of permeability without excess addition of new sand but also eliminates the dust hazard surrounding the equipment.

Fig. 1 illustrates a typical sand reclamation, reconditioning and control unit used in many steel, malleable and gray iron foundries for preparing facing sand, rebonding additions to heap sand and reclaiming sand formerly discharged as refuse.

The unit consists of a shakeout grate at floor level into which the sand is charged. The sand is carried on a belt conveyor over a magnetic pulley to remove metallic refuse. The sand is delivered to the elevator and thence to a revolving hexagonal screen where core butts and other refuse are removed. The cleaned and screened sand is charged into the storage hopper located over measuring hoppers immediately above the mullers. Aerators are mounted on the discharge doors of the mixers to aerate the sand automatically as it falls from the mixers into boxes for transportation to the molders' floors.

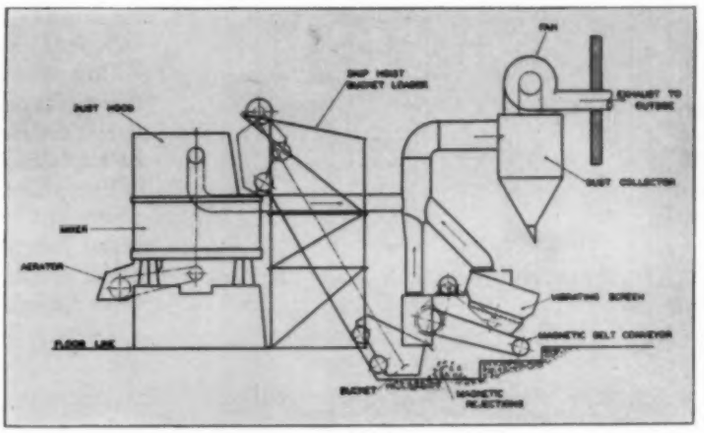


Fig. 2—Simple sand reclaiming, conditioning and control unit used in small production gray iron, malleable, steel and nonferrous foundries

The unit is hooded, housed and exhausted with dampers in each of the exhaust outlets to control the amount of fines removed. All additions of new sand, bond, moisture, sea coal, cereal binder, etc., are made in the mixer so that each batch of sand, within limits, may be as desired. A minimum amount of new sand or bond is required and maximum uniformity and control are obtained.

Analysis of savings effected by such a unit in operation in a malleable foundry pouring approximately 100 tons per day is shown in the accompanying table. The unit was installed in December, 1934 and put into operation Jan. 1, 1935. Savings in sand costs paid for the unit in 8 months. Improvement in quality of product, reduction in cleaning costs and scrap losses represent additional profit which appropriately may be included.

Reduce Amount of New Sand

Steel foundries not equipped to reclaim used sand require from 1800 to 2500 pounds of new silica sand per ton of good castings. Several steel foundries using equipment similar to that shown in Fig. 1 report that their new sand consumption is from 450 to 800 pounds per ton of good castings. In addition they require 50 per cent less clay or bentonite, have lower cleaning costs (from 10 to 25 per cent) and obtain a better surface on the castings with virtual elimination of pin holes and penetration of the metal into the surface of the mold. They are able to maintain permeability within a very close range. One foundry reports 250 to 270 permeability range with 600 pounds new silica sand per ton of castings. Another foundry reports 200 to 215 permeability range with 450 pounds new silica sand per ton of castings, compared to former practice with 90 to 105 permeability and 1800 to 2100 pounds new silica sand per ton of castings.

The batch type muller is said to make it possible in many systems to make all the sand in the system the equivalent of so-called facing sand and thus eliminates the necessity of facing the molds. This helps to speed the molding operation and decreases labor, handling and equipment ordinarily required for facing sand. The unit shown has a production capacity of approximately 50 to 70 tons of properly prepared sand per hour. Units may be larger or smaller.

Many such systems are operating with moisture as low at 2.5 to 3 per cent, with bond strengths from 8 pounds to 11 pounds per square inch (A. F. A. compression test) As a result the castings peel readily, have a

Please turn to page 80

COST ESTIMATE

Sheet 1 of 1
Estimated by J.J.C.
Date 6 - 4 - 30
Proposal No. 1468 - B
Estimate No. 303
S. Order 3062
E. Record 52067

Customer
Location
Equipment
Consulting Engineer or Contractor

This Estimate Covers ONE Equipment

*Purchased Material includes only such purchased material that enters into the equipment upon which NO LABOR has been expended by us.

**Other Material includes all parts made by us and any purchased material that enters into the equipment upon which LABOR has been expended by us.

No.	Drawing Number	Unit for Assembly	Eng. and Dft.	Patterns Labor	Patterns Material	Tools, Jigs and Fixtures Labor	Tools, Jigs and Fixtures Material	Tool Draft.	Material Purchased*	Material Other**	Labor Machining	Labor Assembling	Labor Tank Shop	Testing	Total	Amount
1	X - 12784	400,000 cu. ft. per Hr. Deaeration Heater	175 00	36 00	4 00	30 00	42 00	5 00	1386 87		36 64	34 60	286 34		347 08	
1	X - 12785	8'-0" x 12'-6" Storage Tank	70 00	84 80	10 00				1005 44		22 12		374 40		396 52	
1	X - 12786	127 Sq. Ft. Vent Condenser	80 00	22 50	2 10				68 00	105 50	16 50	9 10			25 50	
1	Z - 2123	8" x 8" Valve Type Float Box	10 00	3 00					2 00	42 25	18 00	4 00			22 00	
8	Z - 2120	8" x 12" Valve Type Float Box	10 00	3 50					24 00	106 00	32 00	4 00			36 00	
1	X - 12787	Piping & Miscellaneous	20 00	6 80					825 00	54 50	14 50	9 75			24 25	
1	234 - S	Insulating Thermometer							15 60							
1		Test Kit							10 00							
	X - 12788	Assembly & Test									50 00				50 00	
		Clerical & Requisitions	15 00													
		Layouts & Etc.	25 00													
											(Includes Purchasing & Inspection Cost).					

Planning

By JAMES J. ZIMMERMAN

serve as a guide to the activities of the plant.

It should also be essentially understood that a definite amount of work will be involved in the use of a routine of this nature and scope of control, and that the volume of work, when once established, cannot be slighted in any phase, without incurring a proportionate reduction in effectiveness and results.

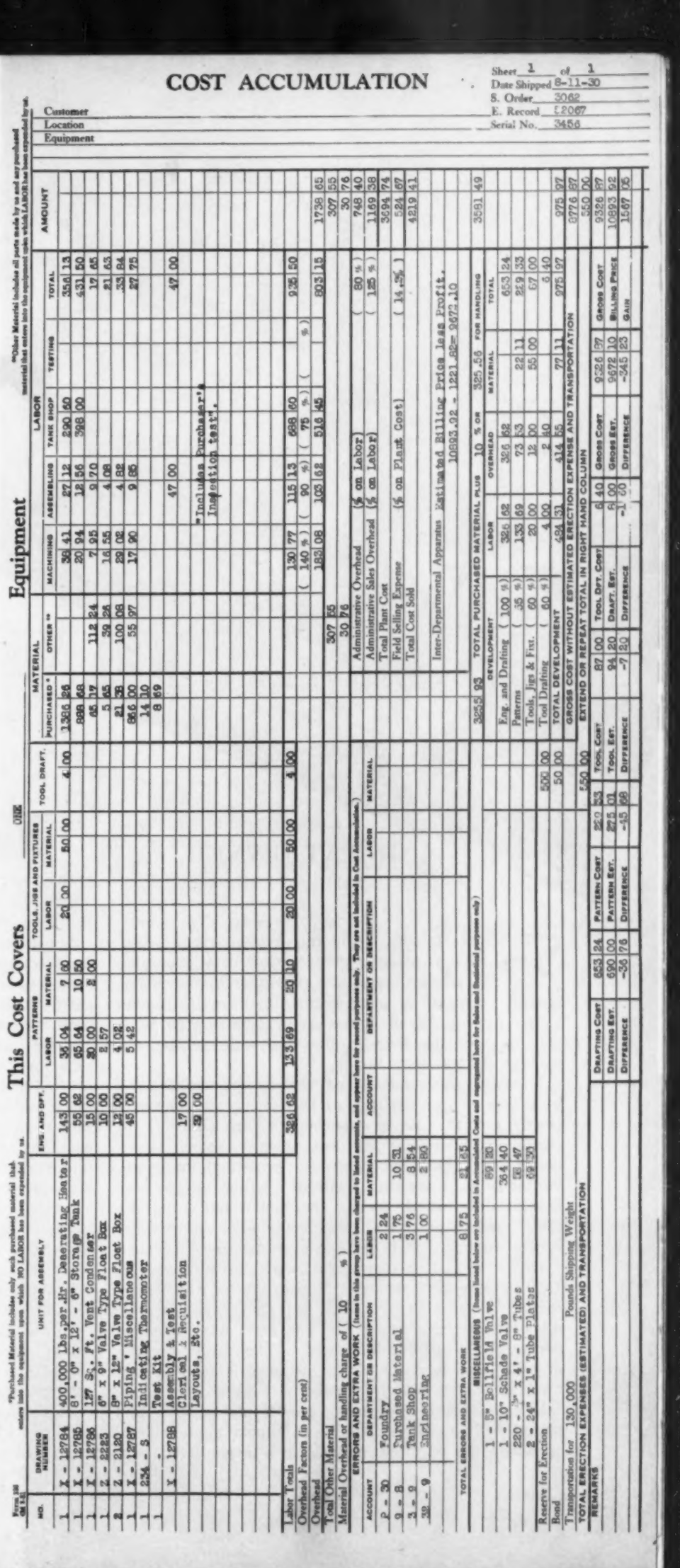
The following discussion presents salient features and functions of a routine such as has been indicated and which has accomplished such results. However, it is not to be assumed that the forms and other functions are directly applicable to all plants. That would be absurd. The writer believes that the principles involved and presented can be adopted and will foster the main objective for the existence of an industry, or to produce legitimate profits.

For brevity, functions, documents, papers etc., will be designated by the following symbols:

UFA Unit for assembly and costing purposes.

SDE Sales department estimate.
SCE Shop cost estimate.
BM Bill of material.
SO Shop order.
TT Returned time ticket.
CA Return shop cost accumulation.
ACD Accumulated cost data sheet.

Creation and use of definite units, into which estimates, bills of material and cost accumulations are broken down and according to which orders are issued, shop work is executed and assemblies are made, sets up a common basis for analysis, control and comparison of all plant activities and justly may be termed the basic prin- (*Please turn to page* 77)



COST ACCUMULATION

Sheet 1 of 1
Date Shipped 8-11-30
S. Order 3062
E. Record 12067
Serial No. 3456

Customer
Location
Equipment

This Cost Covers Equipment

NO.	DRAWING NUMBER	UNIT FOR ASSEMBLY	ENG. AND DFT.	PATTERNS LABOR	PATTERNS MATERIAL	TOOLS, JIGS AND FIXTURES LABOR	TOOLS, JIGS AND FIXTURES MATERIAL	TOOL DRAFT.	MATERIAL PURCHASED *	MATERIAL OTHER **	LABOR MACHINING	LABOR ASSEMBLING	LABOR TANK SHOP	LABOR TESTING	AMOUNT TOTAL
1	X - 12784	400,000 lbs per Hr. Generating Heater	143 00	36 04	7 00	20 00	50 00	4 00	1386 26		36 41	27 12	290 60		356 13
1	X - 12785	8' - 0" x 12' - 6" Storage Tank	55 62	65 04	10 50				888 68		20 94	18 56	398 00		431 50
1	X - 12786	127 Sq. Ft. Vent Condenser	15 00	30 00	8 00										
1	Z - 2223	6" x 9" Valve Type Float Box	10 00	2 57					65 19	112 24	7 95	9 70			17 65
2	Z - 2120	8" x 12" Valve Type Float Box	12 00	4 08					5 65	59 28	16 55	4 08			21 63
1	X - 12787	Piping, Miscellaneous	45 00	5 42					21 38	100 06	29 02	4 82			33 84
1	234 - S	Indicating Thermometer							866 00	55 97	17 90	9 85			27 75
1	-	Test Kit							14 10						
1	X - 12788	Assembly & Test							8 69						
		Clerical & Requisition	17 00									47 00			47 00
		Layouts, Etc.	39 00												
		Labor Totals	326 62	133 69	50 10	20 00	50 00	4 00			130 77	115 13	688 60		936 50
		Overhead Factors (in per cent)									(140 %)	(90 %)	(75 %)	(%)	
		Overhead									183 08	103 62	516 45		803 15
		Total Other Material							307 55						1736 65
		Material Overhead or handling charge of (10 %)							30 76						307 55
															30 76

"Includes Purchaser's Inspection test.

"Other Material includes all parts made by us and any purchased material that enters into the equipment upon which LABOR has been expended by us.

"Purchased Material includes only such purchased material that enters into the equipment upon which NO LABOR has been expended by us.

ERRORS AND EXTRA WORK (Items in this group have been charged to listed accounts, and appear here for record purposes only. They are not included in Cost Accumulation.)

ACCOUNT	DEPARTMENT OR DESCRIPTION	LABOR	MATERIAL	ACCOUNT	DEPARTMENT OR DESCRIPTION	LABOR	MATERIAL
2 - 30	Foundry	2 24					
9 - 8	Purchased Material	1 75	10 31				
3 - 9	Tank Shop	3 76	8 54				
30 - 9	Engineering	1 00	2 80				
	TOTAL ERRORS AND EXTRA WORK	8 75	21 65				

MISCELLANEOUS (Items listed below are included in Accumulated Costs and segregated here for Sales and Statistical purposes only)

1 - 8" Billfield Valve	89 20						
1 - 10" Schade Valve	364 40						
220 - 3" x 4' - 8" Tubes	66 47						
2 - 24" x 1" Tube Plates	69 30						
Reserve for Erection							
Bond							
Transportation for 130,000	Pounds Shipping Weight						
TOTAL ERECTION EXPENSES (ESTIMATED) AND TRANSPORTATION							
REMARKS							

	DRAFTING COST	653 24	PATTERN COST	220 53	TOOL COST		87 00	TOOL DFT. COST		6 40	GROSS COST	9226 87	GROSS COST	9226 87	GROSS COST
	DRAFTING EST.	690 00	PATTERN EST.	275 01	TOOL EST.		94 20	DRAFT. EST.		8 00	GROSS EST.	9672 10	BILLING PRICE	10893 92	BILLING PRICE
	DIFFERENCE	-36 76	DIFFERENCE	-55 08	DIFFERENCE		-7 20	DIFFERENCE		-1 60	DIFFERENCE	-345 23	GAIN	1567 05	

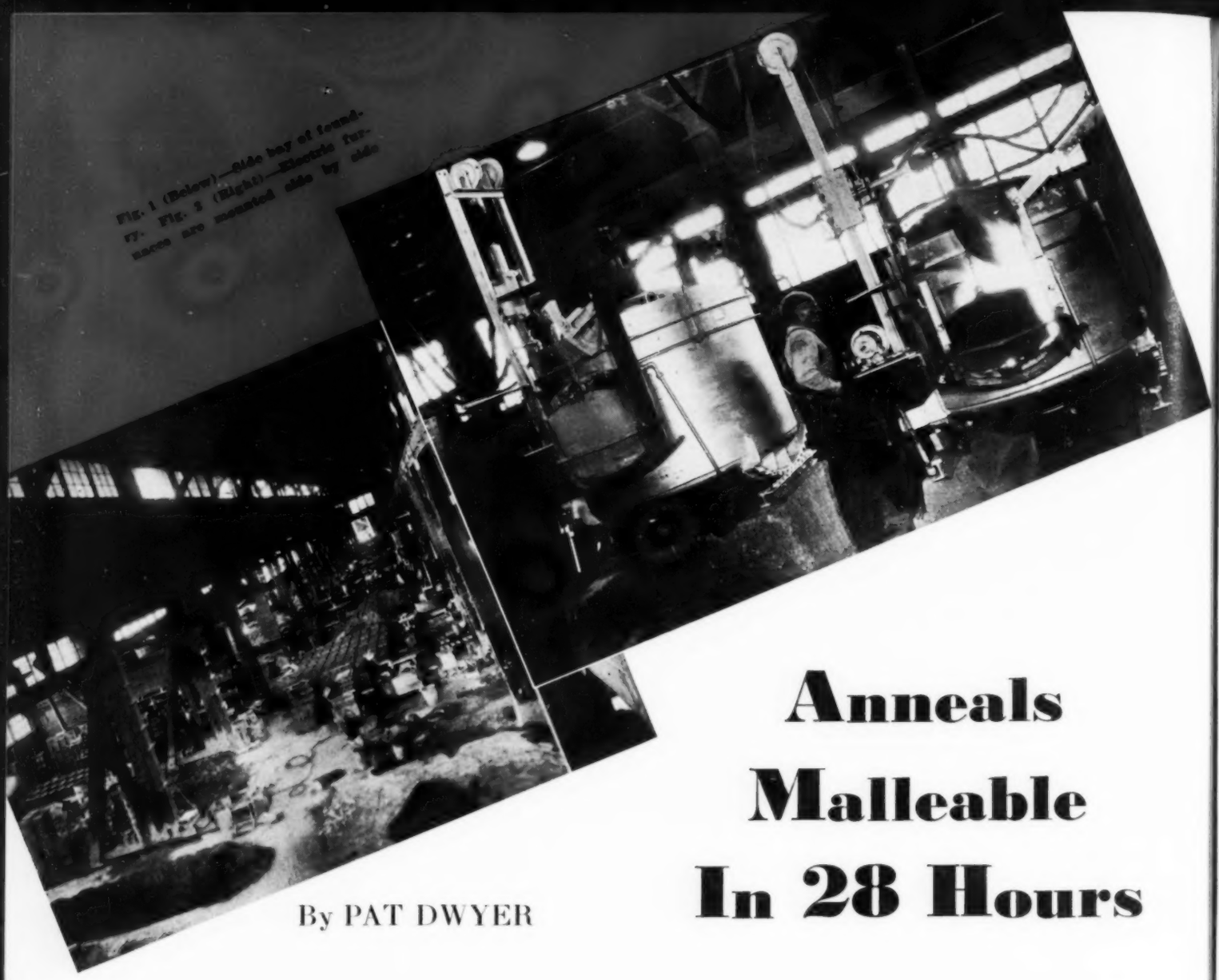


Fig. 1 (Below)—Side bay of foundry. Fig. 2 (Right)—Electric furnaces are mounted side by side

Anneals Malleable In 28 Hours

By PAT DWYER

SEVERAL factors, including availability of electric current at comparatively low cost, prompted C. W. Kucher, president, Olympic Foundry Co., Seattle, to install a small electric melting furnace in 1933. Interest in alloy iron as a promising field for expansion of the foundry business was another important contributory factor.

Following development of various grades of alloy iron, demand for castings of this character showed a steady growth. Early experiments with additions of chromium from 1.00 per cent upward seemed to indicate that the electric furnace presented many advantages as a melting medium. Other alloys were developed to include nickel, also nickel and chromium in various combinations. Methods of manipulation and control in this field have been extended and perfected.

Under normal operating conditions, heats of 1000 to 1500 pounds were melted in the original 48-inch shell furnace. Heats of over 2000 pounds frequently were made in emergencies. This was done with a power demand of about 100 kilowatts. When larger batches of alloy iron were required, the electric furnace was used to melt a definite volume of alloyed iron. This intensified metal then was poured into a ladle and mixed with a definite weight of cupola melted metal to insure the required analysis in a larger batch.

The first, or smaller furnace installed in 1933 was used exclusively for some time melting gray iron. At first it was employed only during the day on single shift. Later it was operated on double shift to cope with steadily increasing orders. Melting metal in the electric furnace facilitated quick delivery of castings at a favorable competitive price. Patterns frequently arrived at the foundry too late for the molds to be made and included in the regular day's heat as melted in the cupola. With the electric furnace in operation, castings from these patterns could be delivered the following morning. Cost of operation was lowered through the use of greater quantities of scrap and a corresponding reduction of pig iron in the charges.

At present the melting equipment includes two furnaces, one with a 48-inch shell and the other a 54-inch diameter shell, operating from a single power supply with control equipment arranged for alternate operation of either furnace. The smaller furnace is used exclusively for melting charges for quick anneal malleable iron castings. The larger furnace is used either for plain or alloy cast iron. Up to the present no attempt has been made to melt metal for steel castings. Power supply is single phase for each furnace equipped with a single, top electrode and bottom terminal construction. Both furnaces are lined for acid

hearth operation as in steel foundry practice.

Satisfactory results in the production of special irons in the electric furnaces suggested the use of the same medium for melting metal for malleable iron castings. A survey of the field indicated that a potential market existed. Gratifying results from several experimental heats induced the company to devote the furnace exclusively to the production of malleable iron and to install a second and larger furnace—54-inch diameter shell—for melting alloy gray iron.

Installation of the second furnace necessitated increase of the power supply to about 200 kilowatts, that is twice the amount required previously on the single small furnace. In addition to the melting furnace a 50-kilowatt electric annealing furnace was installed when regular production of malleable iron castings was undertaken. Later a duplicate annealing furnace was installed to meet the increased demand for malleable iron castings. The melting furnaces were supplied by the Greene Electric Furnace Co., Seattle, while the annealing furnaces were furnished by the Hevi Duty Electric Co., Milwaukee.

Electric Furnace Controls Carbon

Control of carbon is one of the most important advantages claimed for the electric furnace, wnere the carbon may be held at any desired point between a maximum of approximately 4.00 per cent to as low as may be desired either for gray cast iron, alloy iron or malleable iron castings. In this connection it is interesting to note experience of the Olympic Foundry Co. indicates the further advantage of keeping a hearth used for low carbon metal free from charges containing high or excess carbon.

The two furnaces now in operation may be operated simultaneously, but when a limit is placed on the power, such as 150 or 200 kilowatts, it has been found more efficient to use full power in one, than to divide it between two furnaces. Heat loss is more or less constant when a furnace is in continuous operation. Consequently, the quicker the melting, the less is this loss per unit melted.

Rate of power input is a measure of the pounds per hour or the tons per hour which the furnace will melt. In the original installation, that is with the 48-inch diameter shell, it is claimed that with a power input of 100 kilowatts, the furnace melted with an average consumption of 650 kilowatt-hours per ton. Later when the power input was increased to 200 kilowatts the furnace melted more than twice as fast, or with an average consumption of less than 550 kilowatt-hours per ton. In terms of pounds melted per hour, the furnace melts about 300 pounds with 100 kilowatts and when the power is increased to 200 kilowatts it melts nearly 750 pounds per hour. In 24 hours operation the output is 3¼ tons with the lower power and from 8½ to 9 tons with the higher power.

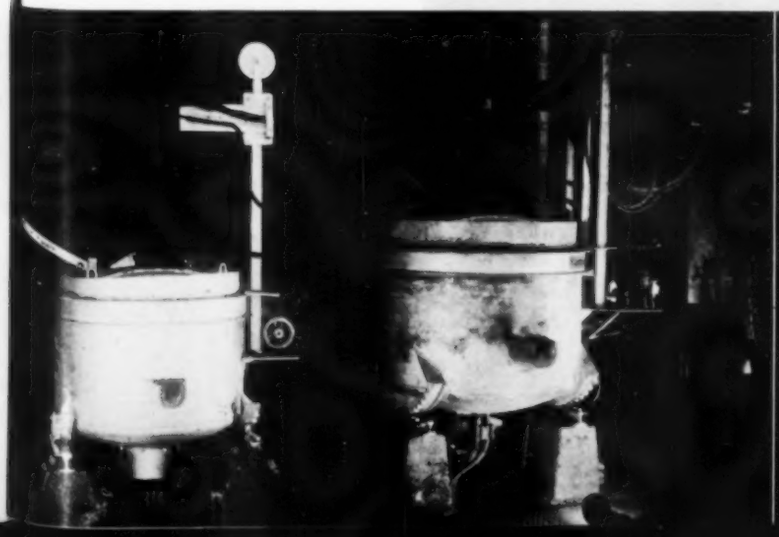
Input Determines Melting Rate

Before leaving this phase of the subject it may be pertinent to point out that the pounds or tons per hour which a furnace will melt is determined primarily by the rate of power input—that is by the indicated power of kilowatts. Through custom in the foundry a furnace is referred to—for example—as a 1-ton furnace when what is meant is that the furnace will melt one ton of metal per hour. A more accurate method would be to state not only the pounds per hour, but also the normal charge which usually is twice that of the pounds per hour. In addition, an electric furnace usually will hold at least 50 per cent more than the normal charge. Frequently even this amount is exceeded, depending on various conditions including the power input.

At the plant of the Olympic Foundry Co. the graphite electrodes for the single phase melting furnaces are 3 inches diameter for 100 kilowatts and 4 inches diameter for 200. Advantages claimed for the single phase design include low first cost, less equipment to maintain and low electrode consumption. Operating at the lower rate of 100 kilowatts the electrode consumption on the smaller furnace over a monthly period is given as less than 1½ pounds per ton of metal melted.

Power for operating the furnaces is brought into the building at 240 volts. In addition to the automatic current regulator, the control equipment includes both voltage and reactance control by special heavy current switches which serve to select either of two voltages and either of two reactance taps within a wide range. This vitally important control equipment is located close to the furnace and takes up only a small amount of space.

Hot iron is tapped regularly from both furnaces.



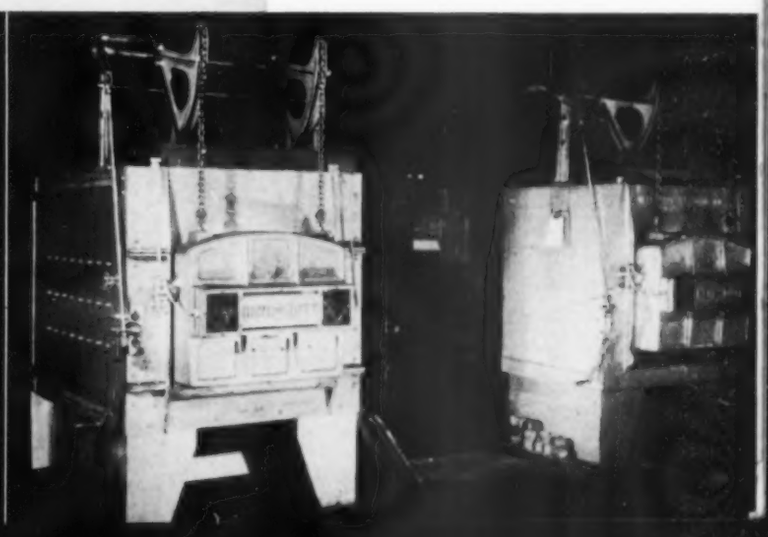


Fig. 3—Tapping side of the electric melting furnaces. Fig. 4 (Right)—Loaded cars are brought up to and taken away from the annealing furnaces on a narrow gage track

Fig. 5—Laboratory control is exercised over raw materials and finished product

Malleable heats of 800 pounds are tapped at a temperature about 100 degrees Fahr. above that at which the metal is poured from a 400-pound ladle into shank ladles. This compensates for the drop in temperature between the furnace and the hard iron molding floors 200 feet distant. Pyrometer readings are taken on all heats.

After the hard iron castings have been shaken out and cleaned they are annealed in an electric furnace. This method which has come into prominence in recent years, a method by which the castings pass through the complete annealing cycle in approximately 28 hours, is known as the *quick anneal* system to distinguish it from the usual method employed in malleable iron foundries where the annealing period extends from 5 to 7 days.

Illustrates Short Annealing Cycle

The chart in Fig. 7 shows that in the electric annealing furnace, the castings are raised to a temperature of 1750 degrees Fahr. in a period of 4 hours. They are held at that temperature for 10 hours and then gradually lowered again to room temperature in a period of 14 hours. With a 2.00 per cent carbon content and a silicon content of 1.50 per cent, malleable castings annealed in the electric furnace show a tensile strength between 55,000 and 60,000 pounds per square inch, a yield point between 38,000 and 40,000 pounds per square inch and elongation of 17 to 25 per cent in 2 inches.

The two electric annealing furnaces shown side by side in Fig. 4 were designed and built by the Hevi-Duty Electric Co. Using only one set of control equipment and instruments the furnaces are so arranged with a double throw switch that while one furnace is heating up, the second furnace is being cooled and loaded. The chamber in each furnace is 24 inches wide, 48 inches deep and 18 inches high with a rating of 50 kilowatts.

In operating the furnace after a preheat and with the annealing boxes in position is brought up to temperature at full heat and then allowed to soak approximately 8 to 10 hours to insure uniform penetration of heat throughout the entire charge. It is then allowed to cool with the door closed to approximately 1200 degrees Fahr. or a point where the castings have been cooled through the critical range. The entire cycle occupies approximately 30 hours.

Employs Round Heating Elements

Interior of the furnace and method of heat application present interesting features. Using round rod elements, each element is laid in an individual groove. The groove is of parabolic shape so that the radiant heat is reflected into the furnace chamber in the same manner that the head lights of an automobile reflect the light rays.

In addition, the groove prevents inter-radiation between the adjacent runs of heating elements and therefore prevents the building up of temperature of the elements. These elements will not exceed the saturated chamber temperature by more than 100 degrees Fahr. at the hottest point. A maximum of heating element life is claimed for this combination which includes efficient means of (*Please turn to page* 80)

Fig. 6—Small malleable castings are made in a section of the foundry set apart for the purpose

Survey Indicates Employment in Foundry Field

GREAT uncertainty exists wherever unemployment in industry is discussed by interested individuals. Statistics issued by governmental departments, by manufacturers associations, and other semipublic institutions seldom are based upon an accurate count. One of the most pressing problems confronting industry is the proper count of those unemployed. Facts, not guesses are needed.

Reports in the foundry industry indicate a high operating rate running through 1936 and but little affected by the summer months which normally mark a recession. Furthermore, a shortage of skilled men exists in practically every large center. The demand for high grade foremen and superintendents exceeds the present supply as is indicated by the inquiries for men of that type which far exceed the number of known applicants for positions.

In the light of the uncertainty which exists THE FOUNDRY obtained from the *New York Sun* permission to analyze a survey of employment presented in its issue of Sept. 5. A count was made by *The Sun* of workers in manufacturing and mechanical industries, trade, mining, transportation and communication. Separate reports were obtained from thousands of companies, many of which are listed by name.

Constitute Industry's Responsibility

In ascertaining its estimate of unemployment using its report figures as a basis *The Sun* used the 1930 United States census. At that time about 28,000,000 or 57.3 per cent of the total in gainful occupations were employed in the various industries previously enumerated. For comparison 1929 was chosen, not as a normal year, but as one in which employment was recognized as occupying a peak. Furthermore, consideration was given to a normal percentage of increase of available workmen.

Applying these factors *The Sun* estimates that of a total unemployed at the present time only 3,593,000 constitute the responsibility of the industries previously mentioned.

In the steel industry the employment total for 1929 is given as 685,250 as compared with 635,427 for 1935, or 92.7 per cent of the 1929 total is reflected in the average employment for 1935. Undoubtedly since the first of the year there has been an increase in the number employed in blast furnaces and steel mills.

The manufacturing and mechanical industries give the following picture:

Employed in 1929	5,991,672
Employed in 1935	5,605,502
Loss from 1929	386,170
1935 per cent of 1929	93.6

Using as a checked reference, *Penton Foundry List*, those firms which operate foundries or which are exclusive castings manufacturers were drawn off from the tabulation made by *The Sun*. These do not include several hundred firms which are listed anonymously and in such manner as to prevent any possible identification.

Of the firms named or identified, 182 operated either jobbing or captive foundries. A tabulation of their employment record is as follows:

Foundries and manufacturing firms operating foundries

Employed in 1929	1,062,308
Employed in 1935	895,350
Loss from 1929	166,958
Percentage of 1929	84.5

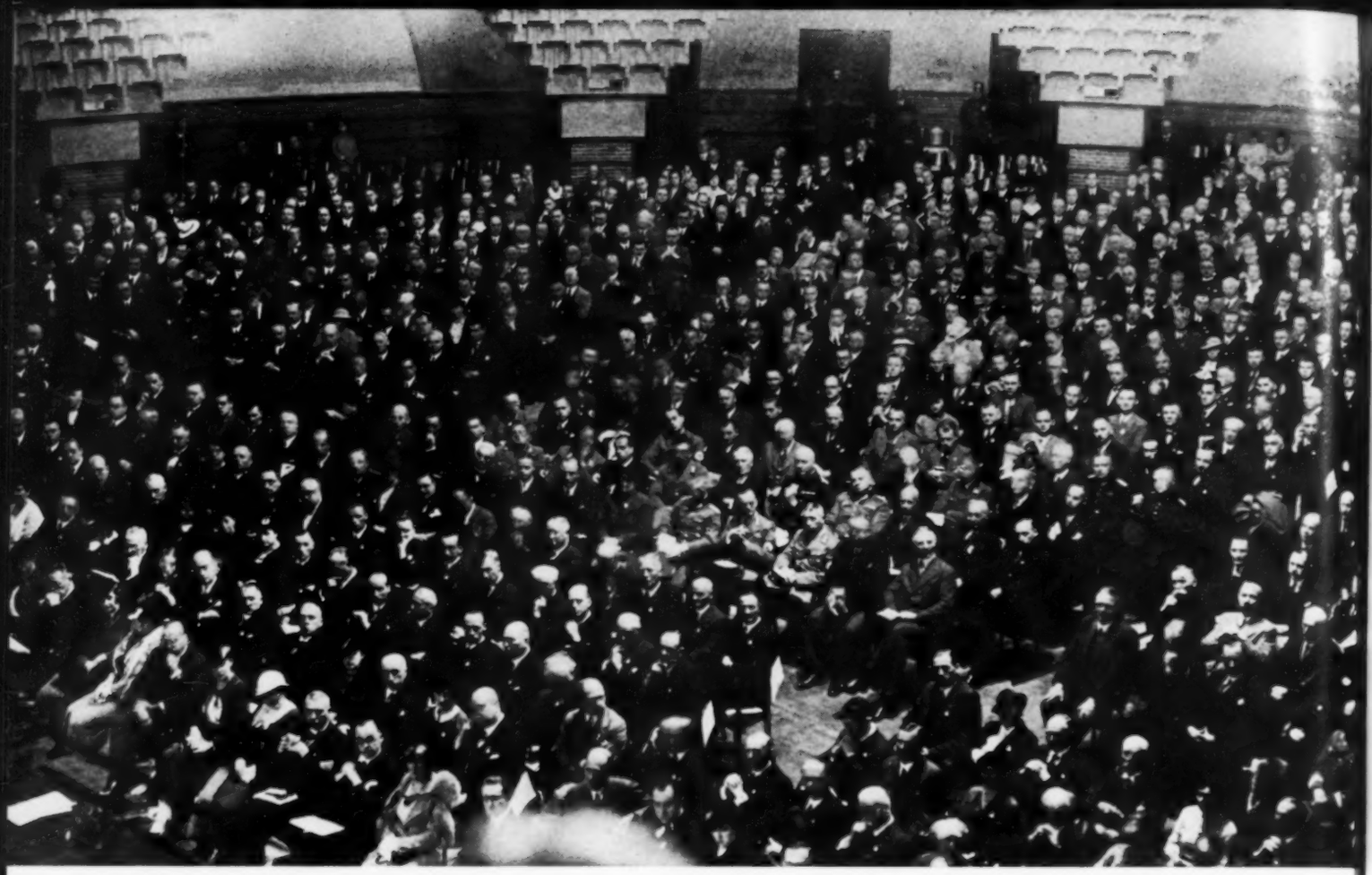
May Not Present Picture

It was possible also in this tabulation to eliminate manufacturing firms which operate their own foundries. This left 81 firms which are identified as making castings entirely for sale. It must be observed that probably half of this number constitute larger institutions such as leading steel and malleable foundries, one or two in the nonferrous classifications, pipe and radiator shops. Therefore, it is doubtful if the analysis of the jobbing foundry employment situation is a true reflection of the overall condition. However, of the 81 jobbing foundries listed, the following summary is possible:

Jobbing Foundries

Employed in 1929	147,575
Employed in 1935	102,208
Loss from 1929	45,367
Percentage of 1929	69.5

These figures are not presented as conclusive evidence of the lower rate of employment obtaining in the foundry industry, as a much more extensive survey covering many more foundries would be required. However, it is apparent by a study of the foundries and manufacturing firms listed that some lag in employment exists in the heavy industries and those dependent on railway equipment manufacture. It is noteworthy also that steam railways in 1935 show 60 per cent of employment in 1929. Metals and metal products which include (*Please turn to page* 83)



Opening meeting of the International Foundry Congress in the Planetarium in Dusseldorf, Germany, on Thursday, Sept. 16

Hold International Congress

By VINCENT DELPORT
European Manager, The Foundry

Preliminary report by mail on Airship Hindenburg. A more detailed report will appear in the November issue

THE Sixth International Foundry Congress and Exhibition was held in Duesseldorf, Germany, from Wednesday, Sept. 16 to Tuesday, Sept. 22. The congress was attended by over 2000 delegates, including many representatives of foreign associations. Twenty-four countries, including the United States were represented.

The formal opening took place on Thursday, Sept. 17 in the Planetarium, with W. Bannenberg, chairman of the German technical foundry association, presiding. J. Leonard, president, International Committee of Foundry Technical associations, occupied the seat of honor. M. Langenohl. director of the federation of foundry industries, supported the chairman.

Chairman Bannenberg opened the meeting by delivering an address of welcome, to which President Leonard replied, in the name of all the foreign foundry associations. M. Langenohl then spoke on behalf of the foundry industry. He was followed by the Reich Minister of Economics, Dr. Schacht, who had flown from Berlin especially to bring an official message of greeting from the government. The Burgomeister of Duesseldorf then gave an address on behalf of the city corporation. Chairman Bannenberg then read the text of a telegram that President Leonard had sent to Herr Hitler on behalf of the foreign delegation, and the Fuehrer's reply also was read.

After the speeches, the delegates were taken over the exhibition, which was staged in the exhibition palace along the Rhine and which was quite remarkable for the complete range of plant equipment and types of castings shown. A considerable section was devoted to educational activities, and from a general point of view as well as from the standpoint of comprehensive interest, up-to-dateness and work of detail, the exhibition was unique. The visit was followed by an official luncheon, at which Dr. Schacht was present.

On the previous day, Wednesday, Sept. 16, the morning was devoted to the registration of members. At noon an excursion by boat on the Rhine to Duisburg was arranged and in Duis- (*Please turn to page* 74)

Company Determines Small Order Price Accurately

TOO often small lot casting orders are a source of loss. This fact is but dimly recognized by many foundries. An exception exists in the case of a leading Ohio foundry making light work. This plant accurately determines the cost of small lot orders and applies this cost to its price. The significant feature of this practice is that the foundry, after submitting a price based on cost, does not retrace from its honestly obtained figures, even though it may lose an order. Through the co-operation of this foundry, the method has been explained.

The unit cost of producing a specific casting in single numbers is far greater than the unit cost of producing that same casting in quantities. However, this cost price would show a fallacy if only one casting were produced, representing only a few minutes or even a few hours work. It is necessary, therefore, for each foundry to determine, from the type work it produces, what constitutes a base production quantity. In any cost system covering the entire output or production of a plant, the exceptional items are absorbed in the departmental overheads, but the way to reduce these overheads is to make an equitable distribution of the extraordinary charges against the various special jobs, to which these expenses are applicable. Therefore, it becomes essential to complete job costs to allocate special or peculiar costs to an individual job.

Study Yields Interesting Results

A study of the routine clerical operations common to all orders in this particular foundry yielded interesting results. Eight general procedures were found necessary, listed as follows: Order received; price checked; order acknowledged; production recorded, including metal mix, coremaking, molding, cleaning, etc.; shipping recorded; billing and general bookkeeping; collections and receipt of pattern equipment if a new job and, of course, the return of pattern equipment. These are all routine operations and merely generalities. Upon further investigation, it is possible to find four or five times the details given.

Cost for an order is the same whether small or large. In this foundry it was found that the regular run for squeezer work properly rigged was two days theoretical molding production. This constituted a base production quantity. In connection with this, the company asks this question: Have you ever given a study to the supervisor's time and labor required to get equipment into production? To get not only the equipment into production but return it to the proper storage space when the order is completed?

Squeezer jobs of the simplest kind require to be rigged for flasks, the jobs must be assigned, coreboxes must go to the core department, these jobs assigned and cleaning methods must be followed. Special machine equipment requires the mounting and dismounting of patterns and at times requires moving and removing the necessary flask equipment from the storage foundry.

After a thorough analysis of these routine operations necessary to all orders and a study of cost and production records, this foundry determined that there was an additional cost of $5 to $6 for less than production quantities; that is, in squeezer work, less than the previously mentioned theoretical base production of two days. This figure included premium allowance and pay to molders.

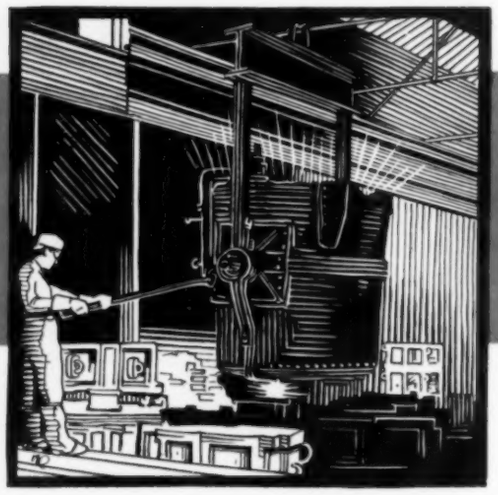
Add Extra Charge to Cost

For a number of years it has been customary for the company to pay a premium on its standard mold piece-work on squeezer work for less than two days' theoretical production. These premiums run as high as 50 per cent above the standard piece work rate for jobs requiring less than two hours to make. After this cost study had been made, it was determined that this extra charge was to be added to the cost as determined from the standard basis. Therefore the two days' production, or the quantity for which no molders piece work premium was allowed, was considered as base.

In connection with the molders premium paid on short orders, the company considers that its general overheads are such that they absorb the expense of a job if it is of two days or more duration. If the job is between one and two days, the piece-work price carries a 5 per cent premium; if between one-half and one day, the price carries a 15 per cent premium; between one-quarter and one-half day, a 30 per cent premium and less than one-quarter of a day, the piece work price carries a premium of 50 per cent.

The next quantity was set up as one day's production so that on casting quantities that could be produced in one day and under two days, a $4 charge was added, divided over the pounds of castings ordered. The next range was from one-quarter to under one day, or from two to eight hours, with a $4.50 charge added. The smallest quantity, of one-quarter of a day or less, absorbed $5 additional cost. Experience has proved to the company that except in unusual cases or an exceptionally small quantity of a multiple pattern equipment job, costs generally are covered.

In working out this sched- (*Please turn to page* 83)



Questions and Answers

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Ingot Mold Castings Are Made in Dried Molds

We shall appreciate any information on the manufacture of ingot mold castings. We understand these molds are made in the ground and are some 5 or 6 feet deep. Also we have been given to understand that the molds are coated with various preparations including asphalt and gasoline mixtures and aluminum paint. How are these coatings applied? Are the molds made in the ordinary manner, that is made in halves and then assembled? What is the diameter of the average ingot mold?

Ingot molds are made in an almost infinite variety of styles and sizes ranging in weight from 200 pounds to 200 tons, round, square, rectangular, fluted and special shapes which reduce the number of initial passes of the resulting steel ingot through the blooming mill. All these castings are molded vertically in iron or steel flasks and poured in a vertical position, usually, but not invariably in a pit in the floor. The mold and core are dried and the metal enters the bottom of the mold from a long sprue located in the flask. Equipment for making the mold includes a base plate, a flask in two parts jointed vertically, a hinged corebox, a core arbor and—in some instances—a cope.

Ford Motor Co., employs a different method, but so far as we know, this company is alone in this respect. At the Ford plant the molds are made in the usual manner, that is molded horizontally in two halves. After these are dried, an oil sand core is placed in one half. The other half is placed on top and then the entire assembly is turned upon end and poured in the position.

In general ingot mold foundry practice many of the smaller ingot molds are cast in halves, in green sand molds and poured in a horizontal position. This type of construction facilitates their use in the steel plant where the halves are joined and held in position by hoops and wedges. The green sand molds for these castings are faced with dry plumbago. Dry sand molds and cores for large ingot mold castings are faced with wet blacking having the general characteristics of the wet blacking employed on dry sand molds for heavy iron castings. The materials to which you refer, asphalt, gasoline mixtures, tar and paint are employed in some steel plants for coating the inside of the ingot mold castings before the steel is poured into them.

Bridging in the Cupola Causes Slow Melting of Iron

From our 48-inch cupola operated continuously on an 8-hour shift the best we can get is slightly less than 6 tons per hour for the first 4 or 5 hours. Then the melting speed drops to 3 or 4 tons per hour for the remainder of the heat. We have checked the area of the tuyeres and other features and find that they agree with generally accepted standards. The blower supplies 240,000 cubic feet of air per hour.

A cupola lined to 48 inches should melt approximately 8 tons per hour and your blower is supplying enough air to melt that amount. Apparently one or more of the several features to which you do not refer may be responsible for the slow melting. It is possible that the iron charges are too heavy, or that the calorific value of the coke is not high enough to melt the iron at maximum speed. You can determine this point by decreasing the weight of the individual charges and noting the result. Reduction in the melting speed after the cupola has been in blast for a few hours, of course is due to the fact that the slag has formed a bridge a short distance above the tuyeres and thus reduced the effective melting area.

In some instances this bridge may be traced to heavy charges which are too long in passing a given point. In other instances the bridge may be caused by excess blast which cools the slag. In still other instances,

the bridge is due to lack of a sufficient amount of high grade limestone to produce a liquid slag that flows readily through the slag hole. In extreme cases all these factors may be present. A boshed lining and high tuyeres greatly facilitate the melting of all day heats.

Certain features of melting practice which create no trouble on short heats, can not be tolerated on long heats. For example 3000 or even 4000-pound charges may be melted in a 48-inch cupola running for an hour or two. The same weight of charge inevitably will choke the same cupola in 3 or 4 hours. You will have to conduct several experiments to properly synchronize the proper proportions of coke, iron, limestone and blast. At the beginning we suggest 1500 pounds of iron, 200 pounds of coke and 50 pounds of high grade limestone. For a comprehensive understanding of the subject we recommend a perusal of *Melting Iron in the Cupola* by Hurst, which may be ordered through THE FOUNDRY.

Bronze Castings Leak When Subjected to Pressure

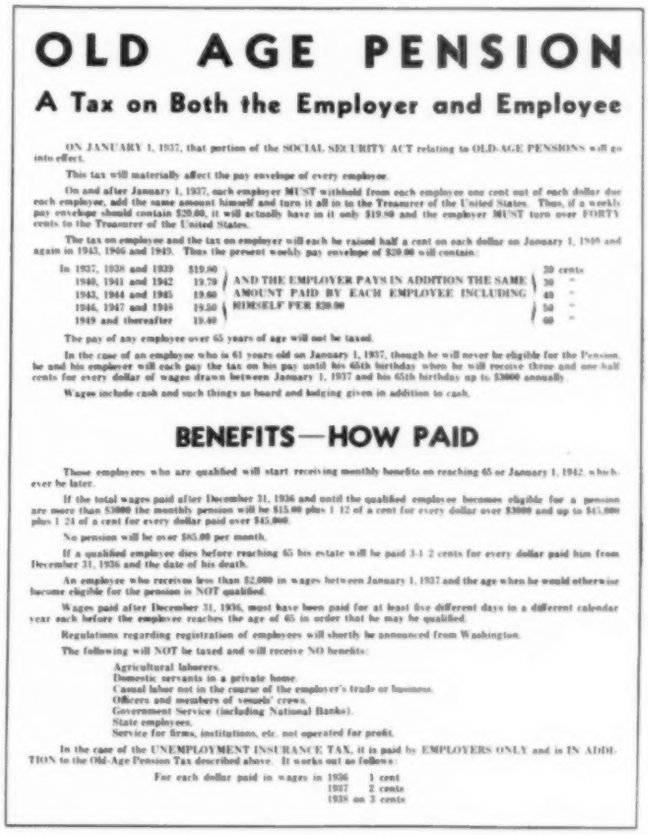
We are making castings for a customer at his specified analysis of 89 per cent copper, 8 per cent tin, 1 per cent lead, 1 per cent zinc and 1 per cent nickel. Castings weigh between 5 and 8 pounds each, being cored with approximately a ¼-inch thick wall. They are machined by our customer and are then brazed onto a 2-inch copper tube. We use a Tobin bronze welding rod for this operation. The customer has experienced difficulty with leaks through our casting, which he tests at between 100 and 200 pounds with both water and steam. He also has a final water pressure test at 400 pounds and this latter test has shown up several breaks in the casting. Our analysis of this problem indicates that what we need is a fairly machinable casting and one which will be dense enough to resist 200 pounds leaking pressure. We would like to have a casting which brazes well and one which will resist unequal stresses set up during the brazing operation.

We assume that the castings you are now producing from the alloy, 89 per cent copper, 8 per cent tin, 1 per cent lead, 1 per cent zinc and 1 per cent nickel are good, sound and satisfactory castings, but when they are subjected to local temperature stresses during brazing, they develop trouble. Obviously, if you were to raise some part of your casting to a high enough temperature to satisfactorily braze it to the copper tubing, the rest of the casting should be raised high enough so that the expansion is not distorting the casting, or internal strains would be set up that would cause cracks or leaks. Before brazing, then, the entire casting should be heated to a reasonably high temperature to insure the relieving of all stresses that would otherwise be set up.

If the leaks that you describe are not caused by this drastic change in temperature, but are the result of improper production of castings of the alloy you describe, then you should look for the correction in your foundry practice. One of the most common places for trouble in melting such alloys as this, is in the furnace where the metal becomes gassed. When the molten metal solidifies in the sand mold, the gases are released and pass off, leaving microscopical passages in the casting through which leakage occurs under hydrostatic pressure tests. To correct this, you should use proper precautions to avoid gassing.

Another cause of trouble in such castings as this is hard cores which do not allow for the shrinkage of the casting during cooling after solidification. Of course, blow holes through tight cores or badly rammed molds will cause leakage; but we take it that you do not have these difficulties.

You ask for a suggested analysis that might help matters and which would stand the pressures described. A very large part of radiator valves and other low pressure valves are made by a number of manufacturers from the following alloy: Tin 6½ per cent, lead 1½ per cent, zinc 2 to 4 per cent, balance copper. This is the alloy specified by the Navy department as 46B8d and known as composition *M* or valve bronze. It is also covered by specifications in the American Society for Testing Materials as valve bronze and is used commonly for valves up to 350 pounds working pressure at not to exceed 450 to 500 degrees Fahr. working temperature. This alloy is such that there is no hard, copper-tin crystal developed during solidification and has a minimum expansion per degree of temperature, and therefore should give minimum trouble during welding. However, we would recommend that the entire casting be elevated in temperature rather than the local spot at which the welding is taking place.



OLD AGE PENSION

A Tax on Both the Employer and Employee

ON JANUARY 1, 1937, that portion of the SOCIAL SECURITY ACT relating to OLD-AGE PENSIONS will go into effect.

This tax will materially affect the pay envelope of every employee.

On and after January 1, 1937, each employer MUST withhold from each employee one cent out of each dollar due each employee, add the same amount himself and turn it all in to the Treasurer of the United States. Thus, if a weekly pay envelope should contain $20.00, it will actually have in it only $19.80 and the employer MUST turn over FORTY cents to the Treasurer of the United States.

The tax on employee and the tax on employer will each be raised half a cent on each dollar on January 1, 1940 and again in 1943, 1946 and 1949. Thus the present weekly pay envelope of $20.00 will contain:

In 1937, 1938 and 1939	$19.80	AND THE EMPLOYER PAYS IN ADDITION THE SAME AMOUNT PAID BY EACH EMPLOYEE INCLUDING HIMSELF FOR $20.00	20 cents
1940, 1941 and 1942	19.70		30 "
1943, 1944 and 1945	19.60		40 "
1946, 1947 and 1948	19.50		50 "
1949 and thereafter	19.40		60 "

The pay of any employee over 65 years of age will not be taxed.

In the case of an employee who is 61 years old on January 1, 1937, though he will never be eligible for the Pension, he and his employer will each pay the tax on his pay until his 65th birthday when he will receive three and one-half cents for every dollar of wages drawn between January 1, 1937 and his 65th birthday up to $3000 annually.

Wages include cash and such things as board and lodging given in addition to cash.

BENEFITS—HOW PAID

Those employees who are qualified will start receiving monthly benefits on reaching 65 or January 1, 1942, whichever be later.

If the total wages paid after December 31, 1936 and until the qualified employee becomes eligible for a pension are more than $3000 the monthly pension will be $15.00 plus 1 12 of a cent for every dollar over $3000 and up to $45,000 plus 1 24 of a cent for every dollar paid over $45,000.

No pension will be over $85.00 per month.

If a qualified employee dies before reaching 65 his estate will be paid 3-1 2 cents for every dollar paid him from December 31, 1936 and the date of his death.

An employee who receives less than $2,000 in wages between January 1, 1937 and the age when he would otherwise become eligible for the pension is NOT qualified.

Wages paid after December 31, 1936, must have been paid for at least five different days in a different calendar year each before the employee reaches the age of 65 in order that he may be qualified.

Regulations regarding registration of employees will shortly be announced from Washington.

The following will NOT be taxed and will receive NO benefits:

Agricultural laborers.
Domestic servants in a private home.
Casual labor not in the course of the employer's trade or business.
Officers and members of vessels' crews.
Government Service (including National Banks).
State employees.
Service for firms, institutions, etc. not operated for profit.

In the case of the UNEMPLOYMENT INSURANCE TAX, it is paid by EMPLOYERS ONLY and is IN ADDITION to the Old-Age Pension Tax described above. It works out as follows:

For each dollar paid in wages in	1936 1 cent
	1937 2 cents
	1938 on 3 cents

Gray Iron Founders' Society Inc., Cleveland, has published for the use of its members a simple explanation of the Social Security act and its operation. This is shown in the illustration accompanying. The same form has been adopted by the Malleable Founders' Society and the Automotive Parts and Equipment Manufacturers Inc.

Iron Castings Are Straightened

Can you give us information on the subject of straightening crooked iron castings by peening the surface.

Practice of peening castings is fairly common, or rather was fairly common in former days when crooked castings were more plentiful than they are today. Columns and other architectural castings presented the most familiar examples. Commencing at both ends and working toward the center, a man patiently hammered the short or concave side of the casting with the ball or flat peen side of a hammer. This universal hammering all over the surface stretched the skin to some extent and also to some extent released the tension responsible for the warp in the first place. In other words the short side of the casting was forced to grow a little. The casting was supported under the center of the convex side and weights were placed on the ends of the concave side to assist in the process.

However, at best it is an after-the-horse-is-stolen remedial measure and will not cure an aggravated case. The proper practice to pursue is to arrange the mold in a manner to produce a straight casting. Heating the crooked casting and then weighting it down in the center of the convex side is practiced in some instances. Jack screws are applied either vertically or laterally in other cases, depending on local conditions. In one prominent automobile foundry, slightly warped cylinder heads are heated to a bright red and then clamped on a surface plate and held there until cold. Shims are placed under the ends and pressure is applied to the center of the upper or convex side.

All Scrap Mixture Causes Trouble

I would like to know if it is possible to make presentable castings from all scrap brass such as old plumbing goods, etc. which can be machined, threads cut upon them, and polished? I am in charge of a small foundry in a school, and the castings are used only for instruction purposes. Consequently, they must be made at the least expense, and remelted after they have served their purpose. At present I have trouble with oxide flakes, and cannot cut threads on the castings. I add a small amount of copper wire and phosphor-copper, but no flux.

Evidently the plumbers' scrap that you are using is a rather heterogeneous collection which would include a wide variety of compositions not to mention aluminized brass which is used where pressure resistance is not a factor. Naturally, such material is far from being satisfactory, and constant remelting without additions of zinc, tin and lead to replace that lost by oxidation does not help it. Also it is advisable when using all scrap to employ some kind of fluxing material to insure coalesence of the minute drosses or slaggy materials into particles which will rise to the surface and be included in the slag which is skimmed off.

It is our opinion that you will save yourself considerable grief by selling your present material to the junk man, and start in with a new supply, rather than trying to clean it up by fluxing. Also we know that you will have less trouble if you buy ingot metal even though its first cost may be a little greater. However, if it is necessary to rely on plumbing scrap, select only those pieces which indicate that they are pressure goods such as faucets, valves, fittings, etc. Then melt the scrap down using broken glass for a flux, and when it is good and hot, stir well, remove the pot from the furnace, skim well and pour into ingots.

Have the ingots drilled to obtain a sample, and then have the drillings analyzed by the chemical department of your school. In the meantime you can make a sample casting or two to see how it fits your needs, or make the castings at the same time you make the ingots. If the material is satisfactory, you will have a base to work from when you receive the analysis, and at each remelting you can add small amounts of lead, tin, and zinc to bring the alloy back to the original composition. However, if the ingot is not satisfactory, you can from the analysis, determine how much lead, tin and zinc are needed to meet your requirements.

For your purpose a number of alloys will be suitable, and undoubtedly, the suggested materials melted down will be satisfactory. However, if you want to work to a definite composition there are three suggestions on suitable alloys. One is the 85 per cent copper, 5 per cent tin, 5 per cent lead and and 5 per cent zinc alloy usually called ounce metal. Another with slightly less tin more lead and higher zinc contains about 79 per cent copper, 8 per cent lead, 3 per cent tin, and 10 per cent zinc. A third alloy contains 72.50 per cent copper, 2.5 per cent lead, 2 per cent tin, and 23 per cent zinc.

In remelting, it is suggested that you use broken glass for a flux, and a small amount of phosphor copper, say about 2 ounces per 100 pounds of molten metal. Melt the metal fast and hot, and when it is up to temperature remove from the furnace. Permitting the molten metal to remain in contact with the furnace gases longer than necessary tends toward production of gassy metal.

To Prevent Cores Burning In

Can you supply a formula for an inexpensive mixture for dipping cores to prevent burning in. We now are using a clay mixed with gasoline. The coating easily is rubbed off by the action of the molten brass and results in unsatisfactory castings.

Without a knowledge of the refractoriness of the clay you are using we are in no position to offer an opinion on its merits either as a coating material, or in a cost comparison with other materials usually employed in the foundry as core washes. If the clay in itself is satisfactory it may be mixed with any of the usual water soluble core binders and will stick to the core. The most widely used material for this purpose is molasses. About a pint of molasses is added to a pail of water and the refractory coating material then is mixed with the water to the consistency of cream. For exceptional severe service the mixture is made thicker. The following materials are used extensively: Foundry blacking and washes in various grades, plumbago, talc and silica flour. You can secure price quotations from the foundry supply houses and make a selection.

FactorsWhichGovern Type of Pouring

We are confronted with the problem of adopting continuous pouring, or of enlarging our floor space. What is considered the minimum capacity of a gray iron foundry that will justify continuous pouring?

The character of the castings made in any given foundry will decide the practicability of introducing a continuous pouring system. For example if 10 molders are employed, and if each man requires a full day to produce one mold, the continuous pouring system is not necessary. On the other hand if each man produces a considerable number of molds, the continuous system may be introduced to advantage, since the batches of molds are poured in rotation, and as a result each man requires less floor space and may use his given amount of sand several times in the same day. This method always has been practiced in brass foundries where the metal is melted and poured continuously throughout the day. The

method may be adopted in a gray iron foundry, even where the total volume of metal handled does not exceed one or two tons.

Only two factors have to be synchronized, the total number of molds made in a day, and the melting speed of the cupola. Instead of melting and pouring the entire heat in a period of 1 or 2 hours, from a large cupola, a smaller cupola is employed to melt the same amount of iron in a period of 6, 7, or 8 hours. Assuming that the present cupola is 36 inches diameter inside the lining, capable of melting the usual daily heat of 5 tons in 1 hour. Assuming further that business warrants the employment of a sufficient number of molders to double this production. Double the number of men can be accommodated on the present floor space if the molds are poured in batches instead of being allowed to accumulate and take up floor space. To pour a total of 20,000 pounds of iron in — say — 6 hours will require a cupola capable of melting approximately 3500 pounds per hour. In other words, a cupola lined to about 27 inches.

Water Heater Is Not to Blame

We have had complaints from customers about rust in the water which they blame on the water heater castings. This rusty water appears after the heaters have been in use a few weeks. In some instances we have taken the Heaters down, flushed them clean and replaced them. In a few weeks the water again is rusty. Is there a special iron mixture, or special core composition which will prevent this? Should the cores be blacked?

Your customers' complaint is totally unfounded so far as you are concerned. The rust of which they complain is not generated in the water heater castings. The sediment is in the water and gradually accumulates in the tank. The amount at first is small and is not noticed. After a few weeks the amount is sufficient to be noticeable. Where the water is drawn off intermittently with comparatively long rest periods, the sediment settles to the bottom.

Where the water is drawn off fairly regularly the constant intake and outgo keeps the sediment in suspension and it flows through the taps regularly. This is particularly noticeable where the heat is on long enough to cause the water to boil. The agitation in the tank is severe. The remedy is to pass the water through a purifier before it goes through the heater. A temporary, but troublesome remedy is to drain the water tank through the bottom valve at frequent intervals. Cast iron does not rust in ordinary service, but the inside surface of the tank rusts to a considerable extent and that accounts for a certain amount of the rust in the water.

Refractory Sand For Hot Metal

In changing from cupola to electric iron is it necessary to use a different grade of sand in the molds? Is it necessary to dry the molds for small and medium size castings? Does the greater shrinkage on this high test alloy iron involve the use of internal chills in some places and larger risers on heavier sections?

Practically the same method of procedure and the same materials are used in all iron foundries irrespective of whether the metal is melted in an electric furnace, a cupola or any other type of furnace. A more refractory sand is required where the metal is poured exceedingly hot, than where it is poured cold. Although the metal is melted hot in the electric furnace, it is not necessarily poured at that temperature, particularly in large, heavy castings.

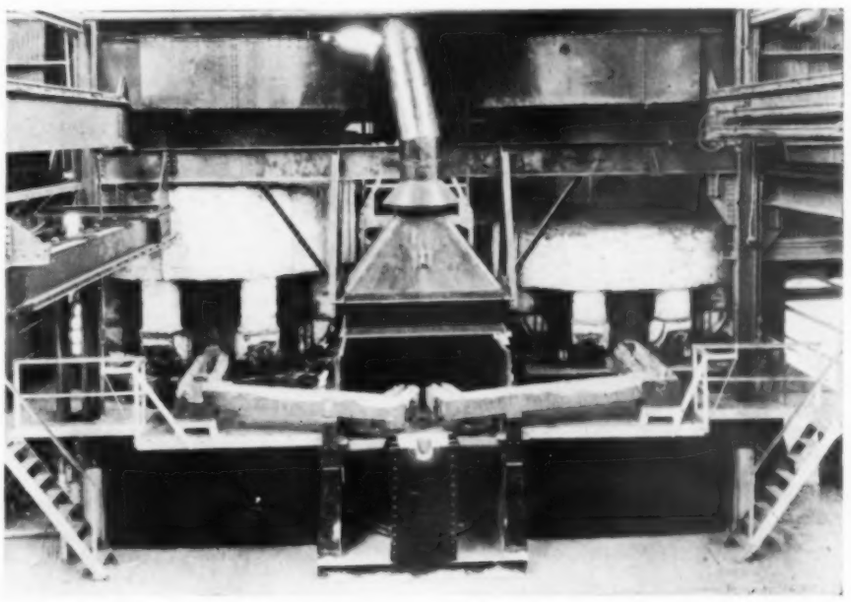
From the appearance of the castings you can easily determine whether the sand at present in use is suitable or not. Molding methods and the advisability of skin drying or oven drying the molds depend on factors other than the metal or the manner in which it is melted. These factors include the shape and size of the casting, the general character of the sand and — in some instances — the position of the gates. Alloy irons, particularly iron containing chromium, shrinks more than ordinary gray iron, but that is a minor detail easily taken care of.

Lower the Silicon To Densen Structure

We are sending a small iron roller 1¾ inches diameter and ¾-inch thick which shows an open grain structure. Would you consider this a good grade of iron, and if not how can we improve it? We use in the cupola charge 30 per cent No. 1 cast scrap containing some steel, 25 domestic scrap, 25 per cent pig iron containing 2.00 per cent silicon, and 20 per cent pig iron containing 3.00 per cent silicon.

The term "a good grade of iron" is rather indefinite, since a grade perfectly suitable for one class of castings, would be utterly unfit for another class. In this particular instance the iron apparently is clean, homogeneous and eminently fitted for use as a roller where the load is comparatively light. However, if the roller is to assume a highly polished surface, or if it has to withstand severe service, the iron is too soft.

The easiest and most convenient method for securing hard, close grained iron is to reduce the silicon content. The present mixture, less the melting loss will yield an iron with a silicon content of approximately 2.00 per cent. By dropping this to 1.50 per cent the iron in the roller casting will be harder and finer grained.



An interesting installation where the metal from two cupolas is directed to a central mixing ladle through special spouts. Illustration courtesy Florence Pipe Foundry & Machine Co., Florence, N. J.

Wilbur C. Schade

Vincent Delport

W. B. Coleman

W. E. Crocombe

MEN OF INDUSTRY

WILBUR C. SCHADE has been appointed manager of the alloy castings department, Ross Meehan Foundries, Chattanooga, Tenn. Mr. Schade has had wide experience in the foundry industry, both as a practical foundryman and as an executive. At the age of 25 he was superintendent of the S. Jarvis Adams plant at Midland, Pa., a large production foundry. Five years later he became vice president and general manager of the Phoenix Iron Works Co. During the 11 years he has been with the Ross-Meehan Foundries, the company has specialized in special-purpose castings from many alloy irons which he developed.

♦ ♦ ♦

VINCENT DELPORT, European manager of THE FOUNDRY, manager of Penton Publishing Co. Ltd., Caxton House, London England, and European representative of the American Foundrymen's association, was elevated to the presidency of the International Committee of Foundry Technical associations, during the recent International Foundry congress at Dusseldorf, Germany. Membership of the international committee is composed of representatives of foundry technical associations from the United States, Great Britain, France, Germany, Czechoslovakia, Holland, Italy, Poland and Spain.

Born in London, England, in 1888, Mr. Delport received his education in France, graduating from the University of Paris with a bachelor of science degree and from the Ecole Centrale des Arts et Manufacturs, Paris, as metallurgical engineer. During the war he served with the French army in the artillery and was awarded the Croix de Guerre. He came to the United States in 1917 with the Tardieu mission and after the Armistice, was attached to the French high commission in New York.

Following the war, Mr. Delport became associated with the United States Steel Products Co., in New York and Paris. From 1921 to 1923 he was consulting engineer and manufacturers' agent in Paris. He was appointed French correspondent for the Penton Publishing Co., Cleveland, in 1922 and became manager of the Penton Publishing Co. Ltd., London, European subsidiary of the American company, in 1924.

Mr. Delport was appointed European representative of the A.F.A. in 1925 and has served as a member of its International Relations committee for some years. In addition, he is a member of the Association Technique de Fonderie de France, British Iron & Steel institute, Institute of British Foundrymen and Societe des Ingenieurs Civils de France.

♦ ♦ ♦

WILLIAM E. CROCOMBE has been elected vice president of the American Brake Shoe & Foundry Co., Chicago. He started in the steel business as an office boy with the Minnesota Iron Co., Minnesota Steamship Co. and the Duluth & Iron Range Railroad Co. When these companies consolidated with the United States Steel Corp., Mr. Crocombe worked in the rail mill and open hearth departments of the Illinois Steel Co., Chicago, until 1907. From 1907 to 1909 he was with the Lackawanna Steel Co., Buffalo, in the open hearth department. From 1909 to 1915 Mr. Crocombe was connected with the Union Drop Forge Co., Chicago. In the latter year he organized the Forst department of the Ajaz Forge Co., now known as the American Forge division of the American Brake Shoe & Foundry Co. Mr. Crocombe was elected president of the American Forge Co. in 1924 and president of the American Manganese Steel Co. in 1933, both companies being important divisions of the American Brake Shoe & Foundry Co.

♦ ♦ ♦

WILLIAM B. COLEMAN, chairman, Philadelphia Metropolitan Chapter of the American Foundrymen's association, is president of the W. B. Coleman Co., chemical and metallurgical consultants.

Mr. Coleman is a graduate of the University of Pennsylvania. His first commercial experience was in the laboratories of the Midvale Steel Co. Later he was placed in charge of the foundries of that organization, making iron, steel and brass castings. Following that he was transferred to the open hearth department, and was made open hearth superintendent in 1915. In the spring of 1918 Mr. Coleman was appointed superintendent of the Tacony Ordnance Corp., a government built plant for the manufacture of field artillery. At the same time he was civilian consultant to the ordnance department at Washington on the manufacture of steel for guns.

After the war the Tacony Ordnance Corp. became one of the com-

(*Continued on page 42*)

OSBORN
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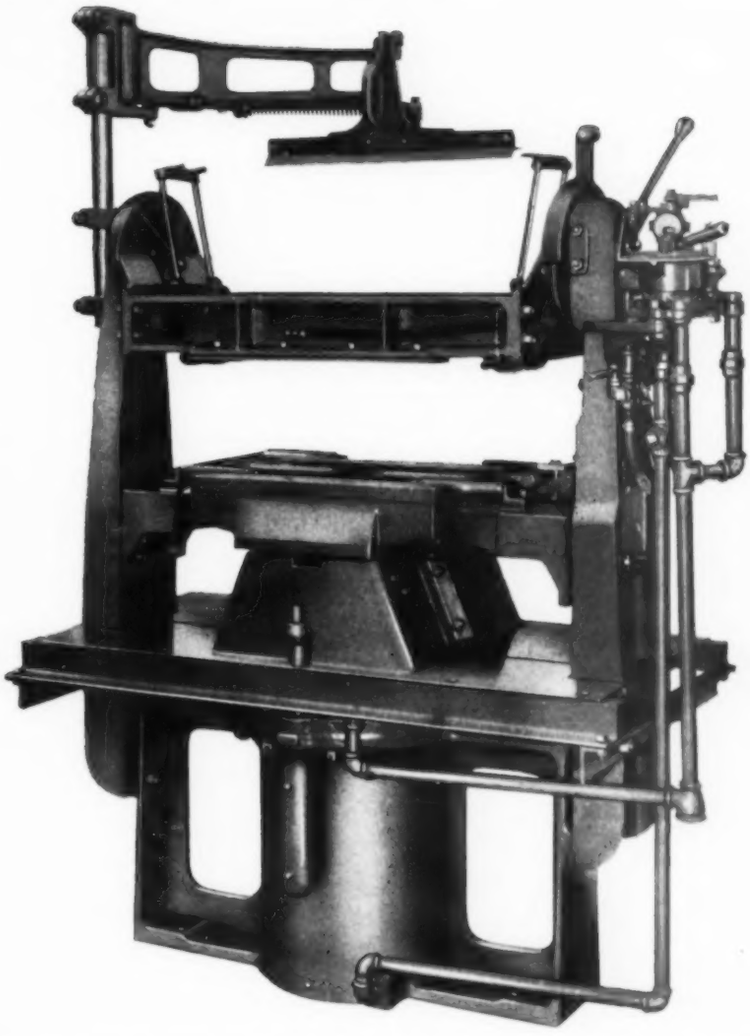

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TIME PROVES VALUES

OSBORN

(*Concluded from page* 40)

panies of the Penn Seaboard Steel Corp. and Mr. Coleman remained as general superintendent, until 1922 when he established his present business.

He has been prominent in technical association work for many years. He is a member of the American Foundrymen's association, American Chemical society, American Institute of Mining and Metallurgical Engineers and the American Society for Metals. He served as president of the A.S.M. in 1933.

♦ ♦ ♦

J. W. WEITZENKORN, formerly president, Molybdenum Corporation of America, has become associated with the Ohio Ferro-Alloys Corp., Canton, O., as director of research.

♦ ♦ ♦

FREDERICK O. SCHRAMM has been named district sales agent for New York and vicinity by the Pittsburgh Steel Foundry Corp. Glassport, Pa. He will have offices at 11 West Forty-second street, New York.

♦ ♦ ♦

L. A. PETO, formerly vice president, comptroller and treasurer of the Canadian Car & Foundry Co. Ltd., Montreal, Que., has been elected vice president and general manager. He is succeeded in his former position by P. C. MCLACHLAN.

♦ ♦ ♦

J. T. HOWAT, formerly affiliated with the Pittsburgh Steel Foundry Corp., Pittsburgh, has been appointed chief metallurgist and superintendent of the heat-treating department of the American Spiral Spring & Mfg. Co., Pittsburgh.

♦ ♦ ♦

C. H. SIPE, formerly general manager of the Brighton Electrical Steel Casting Co., Beaver Falls, Pa., has been elected president of the company to succeed the late D. T SIPE.

♦ ♦ ♦

TOM BARLOW, formerly chief metallurgist, Ecorse Foundry Co., Ecorse, Mich., recently has been made research metallurgist, Battelle Memorial institute, Columbus, O. Mr. Barlow is a graduate of the University of Michigan, Ann Arbor, Mich.

♦ ♦ ♦

WALTER L. BERGHOEFER has been appointed manager of casting sales, Continental Roll & Steel Foundry Co., at East Chicago, Ind. Mr. Berghoefer has been identified with the steel foundry industry for many years as vice president of the National Steel Foundries, Milwaukee. He recently resigned as manager of industrial sales of the Westinghouse Air Brake Co., to assume his new connection.

♦ ♦ ♦

J. C. NIERATH, for the past 20 years vice president and treasurer of the Kilby Mfg. Co., Cleveland has been elected president of the company. He has been associated with the company for 44 years. E. H. Gehlbach, formerly cashier, has been elected treasurer and secretary.

♦ ♦ ♦

H. H. STECK, formerly of the Norton Co., Worcester, Mass., has been appointed Pittsburgh sales representative for United States Rubber Products Inc., New York. For the past 20 years Mr. Steck has been handling grinding wheel sales in that district. He will specialize in high speed wheels.

♦ ♦ ♦

C. E. NOBLE has been appointed sales engineer, Pyrometer Service & Supply Corp., Cleveland. Mr. Noble formerly was connected with the E. C. Atkins Co., Indianapolis, serving 10 years as assistant metallurgist and more recently in the sales organization.

♦ ♦ ♦

H. WEERS, former sales representative of the Fulton Sylphon Co., Knoxville, Tenn., has been named sales manager of the Bass Foundry & Machine Co., Fort Wayne, Ind. He has taken over major responsibilities of the late L. HEELEY LINK, vice president and secretary of the company.

♦ ♦ ♦

CHARLES H. HOEFER recently was made superintendent of the alloy casting division, Lebanon Steel Foundry, Lebanon, Pa. Mr. Hoefer formerly was connected with the Eastern Steel Castings Co., Newark, N. J.; Forging & Casting Corp., Ferndale, Mich.; the Casting Corp., Pittsburgh; and the Empire Steel Castings Co., Reading, Pa.

♦ ♦ ♦

E. J. ASH, formerly engaged in government work at the naval gun factory and Watertown arsenal, Watertown, Mass., has been appointed to the faculty of the University of Michigan, Ann Arbor, Mich., succeeding H. L. CAMPBELL, recently resigned. Mr. Ash attended the common and high schools in Mineral City, O. He received his bachelor of science degree from Heidelberg university, Tiffin, O. in 1925 and his master of science from Ohio State university, Columbus, in 1927.

In June of 1927 he became associated with the Ohio Brass Co., Mansfield, O., as research metallurgist in the malleable iron plant. Later he became connected with the bureau of standards at Washington. Mr. Ash has been active in the technical work of the American Foundrymen's association, presenting papers before the technical meetings and holding membership in several committees including the committee advisory to liquid shrinkage investigation.

♦ ♦ ♦

M. L. JOSEPH has resigned from the United States bureau of mines to become professor of metallurgy at the Minnesota School of Mines and Metallurgy, Minneapolis. For the past year Mr. Joseph supervised a plant investigation conducted jointly by the Inland Steel Co. and the bureau of mines on the effect of oxides in pig iron on the oxides in basic open hearth steel. F. W. SCOTT, who made the oxide determinations in this investigation, has resigned from Inland Steel Co. and is to be associated with Mr. Joseph.

♦ ♦ ♦

EARL D. STEARNS has been appointed sales manager of the Barber-Greene Co., Aurora, Ill. He has been in charge of engineering sales for the company since 1933. Mr. Stearns was affiliated with the Stephens-Adamson Mfg. Co., Aurora, for 12 years, managing the Pittsburgh and New York offices of that company for 8 years. Later he became vice president and sales manager of the H. K. Ferguson Co., Cleveland; president of Stearns Conveyor Co., Cleveland; vice president and sales manager of Fairfield Engineering Co., Marion, O.; and western sales manager of Robins Conveying Belt Co., New York.

♦ ♦ ♦

WILLIAM P. YANT, formerly chief chemist in the health division of the United States bureau of mines, has been appointed director of research of the Mine Safety Appliances Co., Pittsburgh. Graduating from Wooster college, Wooster, O., in 1918, Mr. Yant has been associated with the bureau of mines in various administrative capacities since 1920. His investigations there for the betterment of working conditions in various industries have won him national recognition. He has conducted much of the fundamental work on the dangerous properties of gases, vapors and dusts and the elimination of these hazards. A member of the American Chemical society, the American Institute of Mining and Metallurgical Engineers and other organizations, he is the author of numerous technical papers.

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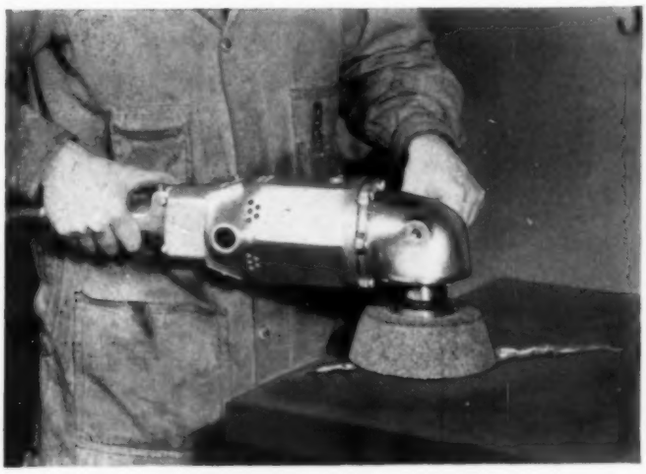

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Gray Cast Iron

By JOHN W. BOLTON

Chapter XI (Concluded)

General Physical Constants

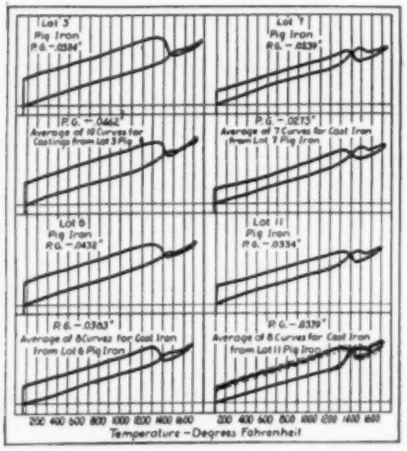


Fig. 127—Dilatometric curves of pig iron and of castings made from them

THE specific gravity or density (relative to water = 1) of commercial gray irons at room temperature varies from about 6.95 for very open grained, high carbon, weak irons to 7.35 for close grained low carbon metals and up to about 7.50 for some of the alloyed high strength irons. (The density of commercial cast steel usually is about 7.80). It has been found that although there is a general approximate correlation between tensile strength and specific gravity, the relationship is far too vague for any hope of prediction of tensility from gravity or vice versa.

Specific gravity usually is an additive function, deducible from the percentages and specific gravities of the structural components. The specific gravities of ordinary structural components of gray iron at 15 to 20 degrees Cent. are as follows: Ferrite, 7.85 to 7.92; graphite, 2.25 to 2.55; cementite, 7.66; pearlite, 7.74; iron phosphide, 6.74; steadite (about) 7.14; iron sulphide, 5.02, and manganese sulphide, 3.99.

A large amount of graphite, due to its low specific gravity, makes the metal lighter. Since the differences in gravity between ferrite and pearlite are not great, elements or factors which increase graphitization have a tendency to lower the specific gravity. Further, gray irons high in total carbon normally can be expected to be somewhat lighter than lower total carbon irons containing a like amount of combined carbon in their makeup.

High Sulphur on Top

The specific gravity of manganese sulphide (3.99) being low, this component tends to float in the molten metal. Advantage has been taken of that fact in attempts to lower the sulphur content of the metal. When a ladle of molten metal is allowed to stand for some time the top material is richer in sulphur, as can be shown by skimmings removed from the surface. Large castings often show higher sulphur on the cope side.

It is well known that the highest strength values are found in irons free from incipient or microscopic shrinkage. Improper feeding (either from faulty gating or too low pouring temperature) causes these microscopic shrinkage cavities. Some commercial castings have some such internal defect or porosity, even though that may not be serious enough to interfere with engineering application. Such porosity may be revealed by specific gravity determinations in addition to other well known methods. If the metal has a lower specific gravity or density than that calculated from its analysis, pouring and molding practice should be investigated and revised to conform to that giving the best results. In hypereutectic gray irons the excess cementite decomposes while the metal still is in a fluid condition. The light graphite resulting floats on the top.

Table XXII—THE FOUNDRY, Nov. 1, 1930, page 87, gives the specific gravity of five medium carbon gray irons as determined on specimens obtained from different sized experimental test bars.

The first two groups of irons shown in Table XXII are high carbon; the second two are lower carbon irons, and the last is an alloy gray iron containing 1.25 per cent nickel and 0.08 per cent chromium. As may be observed, the higher spe-

(*Continued on page* 47)

Table XXII

Specific Gravities of Five Gray Irons

Test Bar Diam.-In.	Total Carbon	Silicon	Manganese	Sulphur	Phosphorus	Tensile lbs. sq. in.	Brinell No.	Sp. Gr. at 20° C.	Pouring Temp. Fahr.
0.50	3.52	2.17	0.60	0.086	0.32	31,347		7.181	
0.75	3.52	2.17	0.60	0.086	0.32	30,243	180	7.112	2440
1.00	3.52	2.17	0.60	0.086	0.32	21,744	162	7.116	to 2350
0.50	3.50	1.71	0.48	0.087	0.36	41,712		7.174	
0.75	3.50	1.71	0.48	0.087	0.36	34,718	189	7.186	2510
1.00	3.50	1.71	0.48	0.087	0.36	29,885	183	7.185	to
2.00	3.50	1.71	0.48	0.087	0.36	18,475	147	7.114	2445
3.00	3.50	1.71	0.48	0.087	0.36	15,056	126	7.054	
0.50	3.26	1.68	0.46	0.083	0.33	43,971		7.214	
0.75	3.26	1.68	0.46	0.083	0.33	38,860	194	7.231	2545
1.00	3.26	1.68	0.46	0.083	0.33	34,575	191	7.140	to
2.00	3.26	1.68	0.46	0.083	0.33	24,248	172	7.087	2490
3.00	3.26	1.68	0.46	0.083	0.33	19,519	160	7.075	
0.50	3.16	2.40	0.57	0.048	0.27	41,887		7.145	
1.00	3.16	2.40	0.57	0.048	0.27	35,380	183	7.161	2540
2.00	3.16	2.40	0.57	0.048	0.27	21,060	146	7.081	to
3.00	3.16	2.40	0.57	0.048	0.27	15,657	99	7.020	2490
0.51	3.29	1.76	0.61	0.079	0.16	40,788		7.312	
0.77	3.29	1.76	0.61	0.079	0.16	37,415	205	7.280	
1.46	3.29	1.76	0.61	0.079	0.16	31,468	209	7.271	
1.95	3.29	1.76	0.61	0.079	0.16	26,880	196	7.282	
2.97	3.29	1.76	0.61	0.079	0.16	24,815	179	7.257	

ADVERTISING PAGES REMOVED

(*Continued from page 44*)

cific gravity of nickel appears to be reflected in the values for specific gravity. Table XXIII gives the specific gravity of gray iron as determined by Hailstone — *Carnegie Memoirs,* Iron and Steel Institute, 1916.

The data show that there is little variation in the various constituents except in the case of the amounts of graphitic and combined carbons. The variations were secured by casting at decreasing temperatures. Comparison of data by Bolton and Hailstone shows comparable specific gravities where pouring temperatures and analysis are similar. As may be noted, gray iron is lighter than many cast metals according to specific gravity determinations by S. A. Weigand: He gives the following: Cast bronze (85-5-5-5), 8.53; cast monel metal, 8.71; cast aluminum bronze, 7.80; and cast steel, 7.84. Moldenke gives the specific gravity of white cast iron as 7.69.

Shows Thermal Conductivity

According to the work of Donaldson — *Proceedings,* Institute of Mechanical Engineers, No. II, 1928, page 953—the thermal conductivities of various cast irons he tested range from 0.110 to 0.137 calories per centimeter per second for 1 degree centigrade temperature difference. This value decreases as the temperature increases, ranging from 0.089 to 0.122 at 570 degrees Fahr. His data show that with combined carbon approximately constant the conductivity decreases somewhat with increase in graphite and silicon content, as is shown in the non-alloy irons grouped in Table XXIV.

Donaldson states that silicon and nickel lower the conductivity appreciably while the effects of manganese and vanadium are similar in direction but less in degree. High silicon steel has lower thermal conductivity than does low silicon steel.

Chromium and tungsten, marked carbide formers, tend to raise the thermal conductivity. His annealing experiments at 1020 degrees Fahr. show that free ferrite is a much better conductor than pearlite overbalancing the effect of the extra graphite formed by the annealing operation. At 212 degrees Fahr. an iron containing 0.68 per cent combined carbon and with 0.122 conductivity showed 0.136 conducitivity when annealed to give 0.12 per cent combined carbon. The conductivity of pure iron at 212 degrees Fahr. is given as 0.151.

Table XXIV

Effect of Graphite and Silicon on Heat Conductivity

Graphite Per Cent	Conductivity at 103 degrees Cent. (212 degrees Fahr.)	Silicon Per Cent
2.95	0.094	1.81
2.65	0.111	1.91
2.74	0.112	2.07
2.55	0.117	1.52
2.51	0.119	1.56
2.48	0.122	1.48
2.29	0.127	1.24
2.44	0.135	0.65

In recent years there have been a number of attempts to investigate the mechanisms of certain reactions in gray irons by means of dilatometric analysis. The effects of temperature changes on the structural condition of the metal may be investigated by various types of thermal analysis. For example the ordinary cooling rate curve indicates changes in state or in constitution because these changes are accompanied by changes in internal (heat) energy—a calorific effect. In a like manner magnetic and electrical properties exhibit discontinuities as a result of certain changes in state or in constitution.

Analyses Fairly Simple

Expansion or dilatometric studies also may be utilized in studies of this type. As a rule the expansion of an aggregate never deviates greatly from what may be predicted from the law of mixtures—the properties are additive. This generally makes interpretation of many dilatrometric analyses fairly simple. However, in a mixture as complex as gray iron apparent anomalies must be given consideration before judgment is passed. Such a metal may not be absolutely solid and microscopic voids or compressible components may give rise to unexpected results.

An interesting utilization of dilatometric methods was made by Boegehold—*Transactions,* American Foundrymen's association, 1929—in his study of certain characteristics of pig irons. He found that the dilation characteristics of the pig iron influence those of the cast iron made therefrom. This is indicated in Fig. 127 and was used to demonstrate the effects of heredity.

Electrical and magnetic properties of gray iron are of practical interest from several points of view. The use of cast iron in electrical machinery offers many problems to the designer. Use of magnetic measurements to determine the soundness of certain castings is an interesting possibility. Electrical, particularly magnetic, changes coincidental with phase changes have application in heat treating methods. Production of nonmagnetic castings may anticipate some demands for material with these characteristics. Existent electrolytic potentials between components are important from a corrosion viewpoint.

Electrical and magnetic properties of gray iron to some degree are predictable from the properties of its components. Graphite, for example, is a well known resister to current passage, and is nonmagnetic. Ferrite, particularly ferrite containing considerable silicon is a fair conductor and has rather high magnetic permeability. Addition of silicon forming silico-ferrite, increases the permeability and the electrical resistance at the same time reducing the magnetic retentivity (opposed to coercive force). The cementite lamellae of the pearlite eutectoid retains magnetism well, and

Table XXIII

Effect of Pouring Temperature

Bar No.	Total Carbon	Graphite	Combined Carbon	Silicon	Sulphur	Phosphorus	Manganese	Specific Gravity	Pouring Temp. Fahr.
1	3.26	2.83	0.43	1.91	0.114	1.48	0.42	7.281	2602
2	3.25	2.84	0.41	1.88	0.097	1.41	0.27	7.262	2552
3	3.26	2.86	0.40	1.90	0.092	1.41	0.27	7.240	2534
4	3.26	2.89	0.37	1.90	0.096	1.41	0.27	7.225	2527
5	3.28	2.92	0.36	1.89	0.096	1.44	0.27	7.201	2482
6	3.28	2.93	0.35	1.90	0.094	1.44	0.27	7.158	2458
7	3.29	2.95	0.34	1.92	0.094	1.46	0.27	7.123	2426
8	3.30	2.99	0.31	1.90	0.093	1.47	0.27	7.085	2343
9	3.31	3.01	0.30	1.90	0.093	1.47	0.27	7.012	2321
10	3.31	3.13	0.18	1.91	0.092	1.47	0.26	6.936	2307

Table XXV

Electrical Resistivity of Cast Iron

Iron	Chemical Analysis as Cast: Total Carbon Per Cent	Graphite Per Cent	Silicon Per Cent	Manganese Per Cent	Specific Resistance: Microhms Per Cu. Cm. As Cast	Annealed
No. 56.....	3.66	2.00	1.33	0.02	78	...
No. 11.....	3.06	1.71	2.54	0.02	86	75
No. 12.....	2.97	1.72	2.87	0.03	90	79
No. 13.....	2.97	1.80	3.41	0.03	108	99
No. 14.....	2.76	1.88	4.76	0.05	188	131
No. 15.....	2.61	2.52	6.04	0.09	192	191
No. 16.....	2.40	2.30	7.38	0.10	218	214

the combined carbon increases the resistivity. Most authorities claim that phosphorus, in ordinary amounts, has little effect on the magnetic and electrical properties.

Effects of various elements may be effective directly, or through action on the structure of the material. As a broad generalism, the electrical properties of an aggregate such as gray iron are additive functions of its components. The most apparent exception to this lies in the formation of solid solutions in various components of the aggregate.

One of the most careful and thorough researches on the magnetic and electrical properties of cast iron is that by H. J. Partridge, Carnegie Scholarship *Memoirs*, 1928. He concludes, "The highest magnetic induction and permeability are obtained with cast iron which has been annealed* (hence all silico-ferrite and graphite). If carbon is 'present as graphite in the nodular form,' *(as in malleable iron) high induction is obtained; if in the form of flakes *(as in gray iron) the specimen possesses low magnetic induction. If the ground mass is ferrite, low hysteresis loss and high permeability appear to be fundamental properties of the material. If the specimen has a pearlitic matrix, it will also possess high hysteresis loss and comparatively low permeability.

Lacks Magnetic Continuity

"Graphite does not affect the hysteresis loss, but prevents the attainment of high magnetic induction. This is due to lack of magnetic continuity of the structure. This lack of continuity causes small demagnetizing forces to act within the specimen. The addition of nickel decreases the magnetic permeability of cast iron to such an extent that it becomes practically nonmagnetic when about 15 per cent of this element is present. Cobalt increases the induction, remanent magnetication, and permeability when added to cast iron, the high induction being due to the graphite existing in a fine state of division. The presence of this element also increases the density, but it has little effect on the coercive force and hysteresis loss, both of which are high. Annealing increases the maximum permeability and decreases the hysteresis loss, coercive force, and remanent magnetism.

Quoting further "The author has shown—that it is possible to produce this material (cast iron) with an hysteresis loss equal to that of soft iron, certainly less than that of wrought iron or mild steel. Frames made of cast iron possessing these properties could be used in the electrical industry, poles could be cast en-bloc with the frame. Cast iron also has the advantage of very high electrical resistance which would reduce eddy currents in the case of an alternating-current generator.—".

Partridge's tests on resistance hysteresis and normal induction are shown in Tables XXV, XXVI and XXVIII. From this and other work we see that thoroughly annealed low carbon iron rather high in silicon possesses desirable magnetic properties for alternating and intermittent currents—such as alternating-current machinery and solenoid cores on make and break circuits. For permanent magnets Ashworth and Pierce—National Physical laboratories, 1905—have shown that white iron low in silicon may possess decided advantages as it has high retentivity.

When heated above the critical range the magnetic pearlite changes to nonmagnetic austenite. This change is the basis of an electrical method for the determination of heat treatment temperature. Certain elements, notably nickel, lower this critical range to such a degree that at about 15 per cent nickel the material is austentitic at room temperatures and hence nonmagnetic. A high nickel-manganese iron developed by Dawson is nonmagnetic. Cast iron containing 20 per cent or more monel metal is practically nonmagnetic.

As a straight resistor or as a conductor it would appear that cast iron has a limited field. Its resistance is fairly high, yet at elevated temperature it oxidizes rather readily. In electromagnetic applications cast iron has not been given proper consideration because its properties are too little understood and improper grades were used—a not unusual reason for similar condemnations of this low cost and easily formed metal.

Insofar as electrolytic potential effects are concerned, the presence of graphite is a detriment to corrosion resistance—the galvanic action setting up more rapid decomposition. However, in many cases the adherent graphite coat on an exposed piece of iron mechanically obstructs access of the corrosive agent. As an aggregate the electrolytic propensities of the metal are undesirable, and for success in corrosion resistance, must be combated by other agencies.

To Handle Hot Blast Cupola Process

Whiting Corp., Harvey, Ill., has made an arrangement with the Griffin Wheel Co., Chicago, whereby the former will sell and manufacture the Griffin hot blast process for cupolas. The Whiting company will continue to handle its pulverized coal fired and stoker fired types of hot blast.

Table XXVI

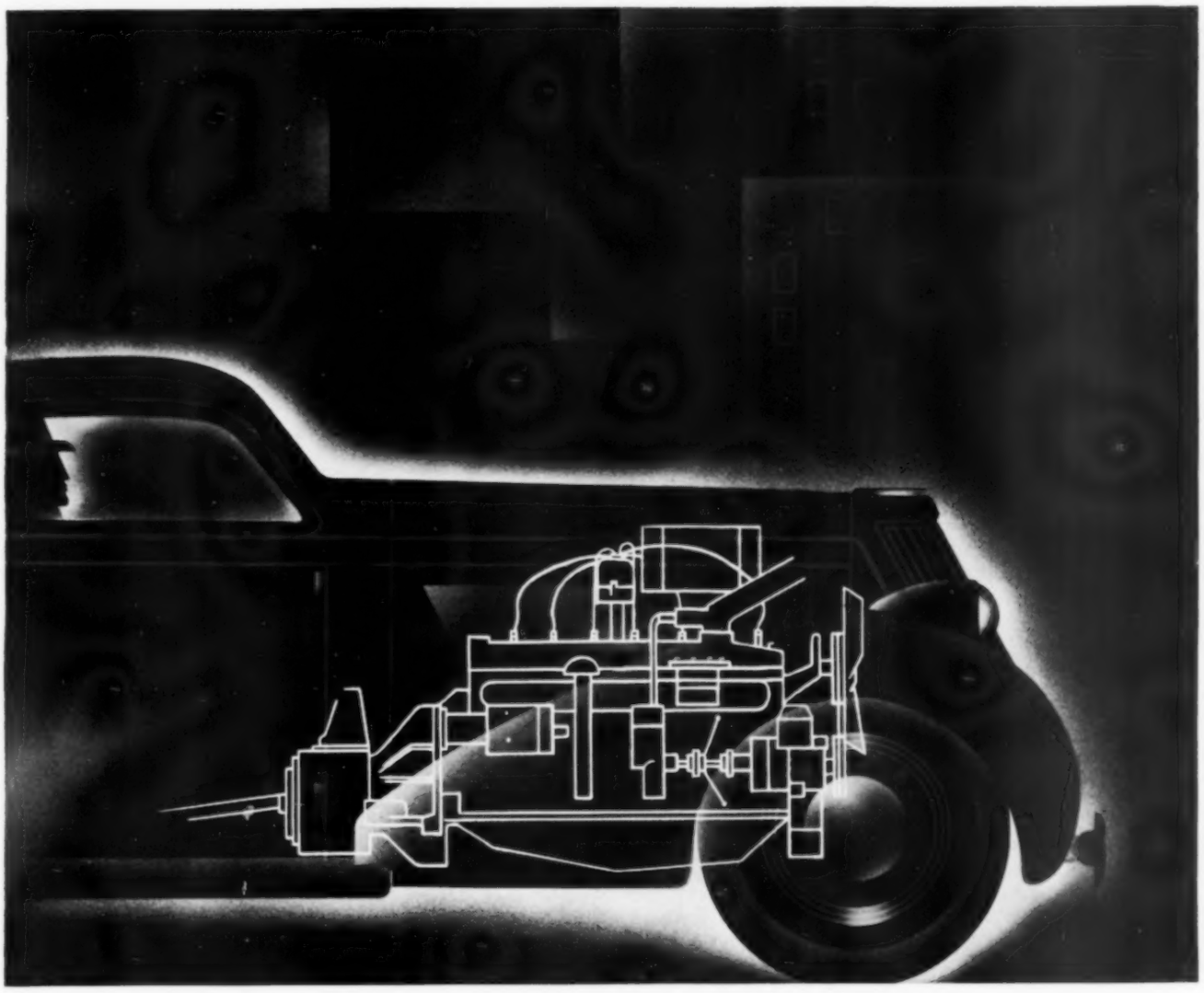
Hysteresis Characteristics (Partridge)

	— No. 11 — As Cast	An-nealed	— No. 12 — As Cast	An-nealed	— No. 13 — As Cast	An-nealed	— No. 14 — As Cast	An-nealed	— No. 15 — As Cast	As Cast	An-nealed
Limits of Induction.....	10,000	9000	10,000	9000	10,000	9000	10,000	9000	8000	4500	8000
Coercive Force...	12.7	4.6	13.1	4.4	12.0	4.4	9.8	3.1	2.2	1.7	2.1
Hysteresis Loss Watts per lb.	20.0	...	20.2	...	18.0	...	14.5	...	2.7	1.6	...

Table XXVII

Normal Induction (Partridge)

	No. 11 As Cast	Annealed	No. 12 As Cast	Annealed	No. 13 As Cast	Annealed	No. 14 As Cast	Annealed	No. 15 As Cast	Annealed	No. 16 As Cast
B max (magnetic flux density)..	10,190	10,980	10,100	10,850	9845	10,350	9455	9950	9200	9125	8935
H max (field strength).....	998	100	100.1	100	100.2	100	100.1	100	99.7	100	97.3
y max (permeability).....	230	680	218	667	213	758	193	295	1021	1020	383
H for *y max*....	16.4	5.0	16.4	5.0	15.2	4.0	20.5	2.6	2.3	1.8	5.9



At the Heart of the Car—MOLY Iron

Modern, more efficient automotive engines require modern, more dependable materials. From the cylinder block to the smallest washer, dependability is the first consideration.

Moly cast iron makes it possible to meet the strictest cylinder block requirements economically. Sections can be as thin as necessary, and still have the requisite strength. The structure of Moly iron is stable at operating temperatures. Wear resistance is excellent, and hardness is uniform regardless of section. Consequently the dependability of the block is high—and its life is longer.

Moly blocks are economical to cast and finish. There are fewer rejects from casting flaws. Fine grain makes it easier to lap bores and bearing bushings to a high polish.

These are the highlights of Moly iron. Fuller details are given in our technical book, "Molybdenum"—yours for the asking. The service and experience of our laboratory are always available to those interested in investigating Moly as a solution for their ferrous problems.

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CUTS COSTS

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Reader's Comment

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of The Foundry or of Its Editors.*

Tells of Russia

TO THE EDITORS:

I want to thank you for your promptness in forwarding my copy of THE FOUNDRY to me each month here in Russia. It surely is a welcome visitor, and I must confess, more appreciated, than when I am at home in the States. Your editorials each month, seem more interesting than ever before, as they seem to convey the message to the American foundryman that it is necessary to be up and doing things, more so, than ever before.

Some how, I connect such thoughts with the foundry progress here in Russia, for everywhere I go, and install our molding machines, I find an eagerness, and a willingness, on the part of the Russian foundrymen to equip and maintain their shops in the best and most modern way possible; and don't let anyone kid you, these Russians are going places in their foundry plans.

At present here in Nizhni Tagil I am installing four 40-inch by 124-inch I.R.O. machines for bolster and side frame work, in a shop for the manufacture of new freight cars. I am told that when this shop is fully complete, it will be the largest in the world for such work. At present it is under construction and is expected to be ready for partial operation (30,000 cars planned for 1937) by the first of the year or before; and the plans are to double this figure in 1938.

Are Reducing Losses

Besides this amount of foundry work for the foundry here, they will supply bolsters, side frames, and car wheels for other car shops as well as for repairs, etc. Their car wheel plant here is in full operation at present, and they operate two sets of Herman machines, two shifts per day for this work and are turning out car wheels about as fast as our foundries in the States; the only difference being that about one fourth more help is used at present than is needed in our wheel foundries. This they claim is due to the fact that this new wheel foundry was only just in operation recently and is not fully organized yet. Foundry loss runs somewhat higher than in foundries in the United States, but their records show that this loss is gradually being reduced.

I have also set up machines in various other plants for work of all description large and small and outstanding among these other foundries are those for making tunnel segments. Four sets of 50-inch by 108-inch I.R.O. machines have been installed and are operating, one and two shifts per day on this work. These shops are located as follows: Two in Moscow, one in Dniepropetrovsk, and one in Kolumna. The Dniepropetrovsk plant is the best planned shop for this work, as it is an entire new foundry, and planned only for tunnel segment castings, while the other three shops are converted foundries, being used formerly for work of other nature.

Sand Is Handicap

At present, I am most familiar with results obtained at Stankolit plant in Moscow. The first tunnel segments were made in this foundry by machines on May 6 last. Within 30 days they reached easily, 15 molds per hour, without the use of the conveyors for taking the molds away. The foundry ran two shifts per day, which soon flooded the machine shop with castings, and later the foundry was reduced to one shift per day, until new machinery could be got into shape for machining the castings as fast as the foundry can turn them out, making two shifts. I have not been in touch with this plant for some weeks now, but their plans are to produce a minimum of 20 molds per hour on two shifts, which amount they will easily accomplish with conveyors. The Dniepropetrovsk plant being a much better laid out foundry will reach 25 or 30 molds per hour, and work two (possibly three) shifts per day.

Sand conditions in shops where I have been are not the best, as they are handicapped for natural bonded sands. However, they combine their sharp sand and what clays they have, into a synthetic sand, and their castings in appearance compare favorably with ours. There is no doubt but what they will master the sand situation in due time. All in all their foundries are progressing, and it is not necessary for a person to have spent a life time here to see this progress, as it is before one's eyes daily.

Again I want to thank you for your promptness in getting each issue of THE FOUNDRY to me while here, and through it send a greeting to my foundry friends in the States.

R. P. MORGAN
Herman Pneumatic Machine Co., Nizhni Tagil, Ural West Siberia, U. S. S. R.

Officers for Chapter At Milwaukee

Officers of the Milwaukee chapter of the American Foundrymen's association for the 1936-37 season are as follows: Chairman, W. F. Bornfleth, foundry division, Cutler-Hammer Inc., Milwaukee; vice chairman, L. S. Peregoy, Sivyer Steel Casting Co., Milwaukee; secretary, C. A. Gutenkunst, Jr., Milwaukee Malleable & Gray Iron Works; treasurer, W. J. Donnelly, George H. Smith Steel Casting Co., Milwaukee; Directors include C. S. Anderson, Belle City Malleable Iron Co., Racine, Wis.; W. J. Grede, Liberty Foundry Inc., Wauwatosa, Wis.; R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee; W. J. McNeill, Federal Malleable Iron Co., West Allis, Wis.; George Miller, Loeffelnolz Co., Milwaukee; E. L. Roth, Motor Castings Co., Milwaukee; and A. C. Ziebell, Universal Foundry Co., Oshkosh, Wis.

Book Review

Corrosion Resistance of Metals and Alloys, by Robert J. McKay and Robert Worthington, 492 pages, published as an American Chemical Society monograph, by the Reinhold Publishing Corp., New York, and supplied by THE FOUNDRY, Cleveland, for $7.00 plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

The purpose of this work is to summarize the facts on corrosion processes and rates. It is inevitable that statements on the facts of corrosion rates will find some disagreement on the part of manufacturers and possible users who hope for better resistance properties, but wisely the volume offers no panacea for corrosion difficulties, contenting itself with an accurate statement of the facts concerning the subject.

General and theoretical discussion is contained in the first part of the work, covering such subjects as the rate factors, forms of corrosion, corrosives and metal corrosion properties. Part II is concerned with the corrosion behavior of specific metal and alloy groups such as magnesium, aluminum zinc, cadmium, tin, lead, iron and steel and silicon-iron, molybdenum, chromium, nickel-iron, nickel, nickel-copper, copper and high copper alloys such as brass, bronze and nickel-silver.

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European Foundry Practice

Digest of Recent Literature Covering Various Phases of Castings Manufacture

Quality Irons

The Production of High-Duty Cast Irons (L'Elboration des Fontes a Hautes Caracteristiques Mecaniques), by Marcel Dudouet. *Bulletin de l'Association Technique de Fonderie,* Paris, February, 1936.

The process described by the author has given good results in obtaining an iron with a pearlite structure and finely-disseminated graphite, and with a total carbon of about 2.8 per cent. The principles of the method depend upon: (a) the treatment of the metal in its liquid state; (b) the time at which additions are made, and their degree of concentration; (c) the physico-chemical constitution of the metal charged; (d) the influence of the slag.

The iron can be melted in the electric furnace or in the cupola. In the first case, the electric furnace can be used alone, starting from cold charges. The duplex method, combining the cupola with the electric furnace, can also be used. However, the cupola still remains the most economical means of melting iron, and high-duty irons can now be made regularly by careful control of the cupola, in which the charges contain steel scrap.

Lemoine has shown that recarburization takes place in two stages: (1) by case-hardening before melting; (2) by direct contact between the liquid metal and the coke. In practice it is possible to limit the first stage to about 2 per cent of carbon by raising the temperature of the melting zone. The final carbon can be limited in the second stage to about 3 per cent, preferably by using a fore-hearth.

It is, therefore, possible to obtain irons with from 2 to 2.8 per cent carbon by melting steel scrap in a cupola provided with a fore-hearth. It is pointed out that by charging metal already containing about 2 per cent carbon, the cupola operates in a much more regular fashion. In practice, good results are obtained by charging 30 per cent of steel scrap, 40 per cent of low-carbon iron, the balance being made up of iron scrap coming from previous castings of the quality required, and additions. Attention is drawn to the choice of virgin iron going into the charge, from the standpoint of its original structure. Addition of silicon in the ladle is strongly recommended.

Iron obtained by this method had an average analysis of: total carbon, 2.85 to 3 per cent; silicon, 1.80 per cent; manganese, 0.80 per cent; sulphur, 0.09 per cent; phosphorus, 0.250 per cent. Castability was good, homogeneity was satisfactory, and the required physical characteristics were met without difficulty. Certain precautions are to be taken in the pouring operation, and these are briefly summarized.

Dealing with the choice of the iron that is charged into the cupola, the author states that in the duplex method it is sufficient that an iron be chosen with not more than 0.25 per cent of phosphorus; the iron coming out of the cupola is then refined in the electric furnace.

When the cupola is employed alone, the charge must contain a large proportion of low-carbon iron. This iron can either be prepared itself in a cupola, or bought from outside. When prepared in the foundry, it is necessary to make additions containing silicon and manganese, which do not exist in sufficient quantities in current steel scrap, to make a careful choice of the nature and the size of the scrap, and to make additions to arrive at the correct stage of graphitization.

It is recommended that part of the addition of silicon should be made in the form of a rich ferrosilicon, to be added at the spout of the cupola. Sodium carbonate should also be added in the ladle to reduce the sulphur content. The pigs should be cast relatively thin, on the side to avoid the contact of air on the upper surface or the pigs.

Toughness

Toughness of Cast Irons from Transverse Stress/Strain Curves, by G. L. Harbach, *Foundry Trade Journal,* London, England, Aug. 20, 1936.

The author describes in this article an investigation made to determine whether properties indicated by transverse stress-strain curves could be used graphically to show toughness of cast irons. From his work he concludes that cast irons have no definite elastic limit and therefore no straight lines in stress-strain curves. If the plastic and elastic components are separated, the elastic portions practically are straight lines and may be used to determine the modulus of elasticity (E) values. In general the E value for cast iron increases with increasing strength.

Practical experience of materials shows that toughness is associated with certain characteristics in the stress-strain curves and when similar characteristics are produced by cast irons they also are associated with good toughness. Cast irons having a low proportion of plastic set are brittle while those having a high proportion tend to be tough. Irons in which the major portion of plastic set occurs near the breaking load are tougher than irons of otherwise similar strengths and deflections. The proportion of plastic set varies roughly with the strength and amounts to between 15 and 25 per cent of the total deflection except in such cases as Niresist when the proportion may be 50 per cent or more. When two irons of similar strength require different amounts of effort to break them it is found that the stress/strain curves are dissimilar, either in E value, proportion of set or the period in the loading when most plasticity develops. Experience shows that toughness is associated with curves which start at a sharp angle (good E value) and continue almost straight (little plastic set) until nearly breaking load when a pronounced bend develops (good plastic set).

Niresist cast irons have a greater proportion of plastic set than ordinary cast irons and invariably are harder to break. When they are associated with fairly high strength and good E values, they are as difficult to break as bronze. From this and results previously reviewed, it may be accepted that a good capacity for plastic deformation coupled with other favorable factors, offsets the effects of comparatively low strength and that toughness is not necessarily related to strength.

It is suggested that transverse stress-strain curves are particularly informative regarding the prop-

erties of the different types of cast irons now available and that the study of them will do much to explain such apparent anomalies as cold-blast irons being tougher than hot-blast irons of similar strength and the toughness of austenitic irons despite their comparatively low strength.

Cement Bonding

Application of Cements as Bond with Sand for Foundry Use (Ueber die Verwendung von Zementen als Bindemittel bei Sanden fuer Giessereizwecke), by Max Paschke, Carl Weymann and Eugen Schneider, *Die Giesserei*, Dusseldorf, Germany, July 31, 1936.

The authors investigated the applicability of cement as a bond for molding sand using two different sands and two types of cement, with varying amounts of cement and moisture. Cements used were regular portland and high alumina, and the quantities varied from 6 to 14 per cent in steps of 2 per cent. The moisture contents varied similarly as the cement contents, and the drying or weathering times on each lot were 3, 5, 7½, 10, 24, 28 and 72 hours.

Compression strength of the original sand was 13.9 pounds per square inch while with the addition of 6 per cent regular portland cement, 6 per cent moisture and drying for 5 hours the strength was 102.4 pounds per square inch; drying for 10 hours the strength was 116.7 pounds per square inch, and for 72 hours the strength was 142.2 pounds per square inch. With high alumina cement at same additions the strength after 5 hours was 71.8 pounds per square inch, and after 10 hours, 142.2 pounds per square inch; after 72 hours the strength was 165 pounds per square inch.

Higher permeability (about 30 per cent) is obtained with high alumina cement additions. With 6 per cent regular portland cement and 6 per cent moisture and 10 hours drying, the sand had a permeability of 103 cubic centimeters per minute; with 8 per cent moisture it was 96 cubic centimeters per minute, while with 10 per cent moisture it was 101 cubic centimeters per minute, then dropping off rapidly with increasing moisture. Using high alumina cement, 6 per cent moisture gave 140 cubic centimeters per minute; 8 per cent moisture gave 130 cubic centimeters per minute; 10 per cent moisture gave 121 cubic centimeters; decreasing rapidly with increasing moisture. Increases of cement content with both types decreased the permeability. For example with 14 per cent regular cement and 6 per cent moisture, the permeability was 80 cubic centimeters per minute; with 14 per cent high alumina cement and 6 per cent moisture the permeability was 112 cubic centimeters per minute.

Additions of both types of cement decrease the softening point below that of either sand or cement. One sand had a softening point of 1480 degrees Cent. which was reduced to 1425 degrees Cent. with 4 per cent cement, and to 1390 degrees Cent. with 8 per cent cement. The other sand had a softening point of 1670 degrees Cent. which was reduced to 1600 degrees Cent. with 4 per cent cement and to 1540 degrees Cent. with 8 per cent cement.

From their investigation the authors conclude that successful application of cement-sand is possible since the permeability is very good, the strength properties exceed the highest requirements, and the refractoriness is adequate for the practice.

Cost of Government Shown in Report

Because no indication has been given of how and when the federal accounts will be brought into balance and because six years of the greatest peace-time deficit have brought with them serious economic, social and political problems, the National Industrial Conference Board Inc., New York, has issued the eleventh of a series on "Cost of Government in the United States." The period covered in this issue is 1933 to 1935.

The report infers that the budget will not be balanced unless present policies are subordinated to budget adjustment and unless the unnecessary political employes are discharged, which is unlikely in an election year.

Discussion and numerous tables show that before the depression, federal expenditures relative to the total declined from the year of 1923 while state and local expenditures increased and that during the depression the trend reversed. Arguments are stated pro and con as to whether emergency needs are a state or federal function. A chart gives the Reconstruction Finance Corp. as the leading spending agency in 1934 and the Federal Emergency Relief administration as first in 1935; of direct payments by the government to the states, New York, Pennsylvania and Illinois received the largest amounts; of federal contingent liabilities, including Federal Farm Mortgage Corp., Federal Farm board; Home Owners Loan Corp., R.F.C., the Home Owners represented the largest portion. Interest payments on federal debt are computed as 35 times as large for 1935 as for 1916.

Although taxes are pictured as rising since 1933, sufficient taxes have not been proposed to bring the accounts into balance according to the report. Under consideration in search for additional revenues is a plan to abandon the present principles of federation taxation of corporate income in use for 20 years. The survey interprets the suggestions for taxation by the President in March, 1936 as intended to restore the 1937 budget to approximately the same position as before the invalidation of the agricultural adjustment taxes and the enactment of the Adjusted Compensation Payment act of 1936. The statement is made that this uncertainty in regard to future federal taxation is an outstanding problem confronting business at the present time.

Another problem stressed lies in the fact that 80 per cent of the increase in federal debt since 1930 has been absorbed by the banks, a trend which the survey labels as inflation. The report closes with a gloomy forboding of what might happen should there be a loss of confidence in federal issues accompanied by a decline in the confidence of depositors in the stability of the banking system.

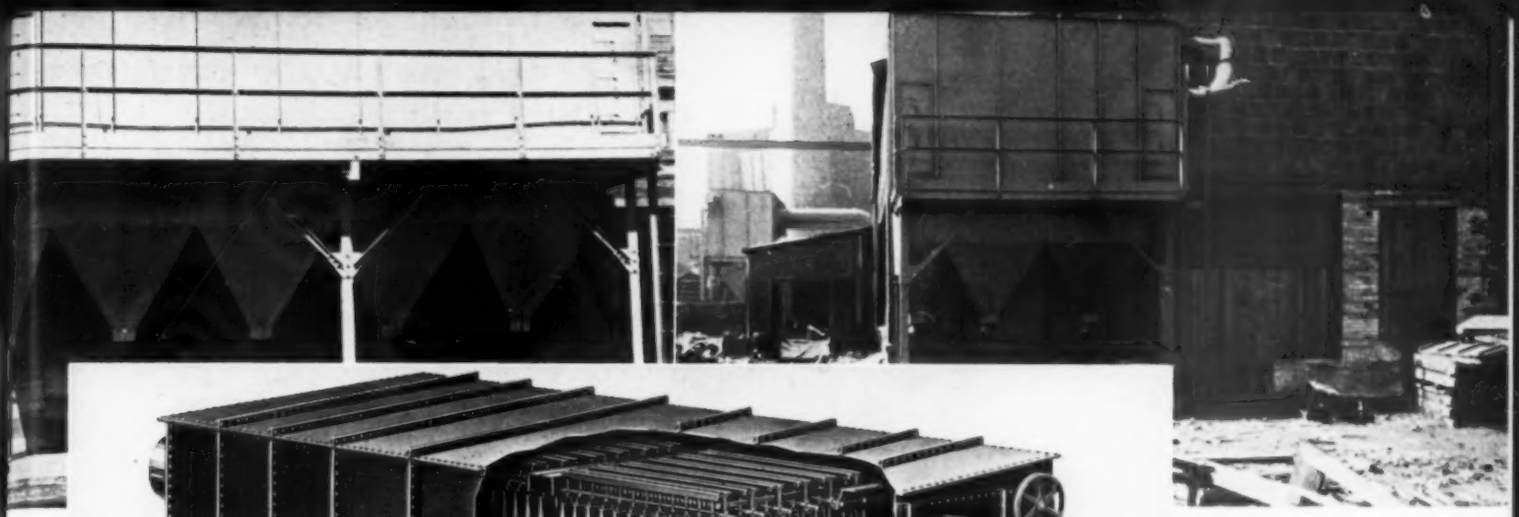
An appendix presents sources and methods of arriving at data, estimates and the 33 tables and six charts.

Book Review

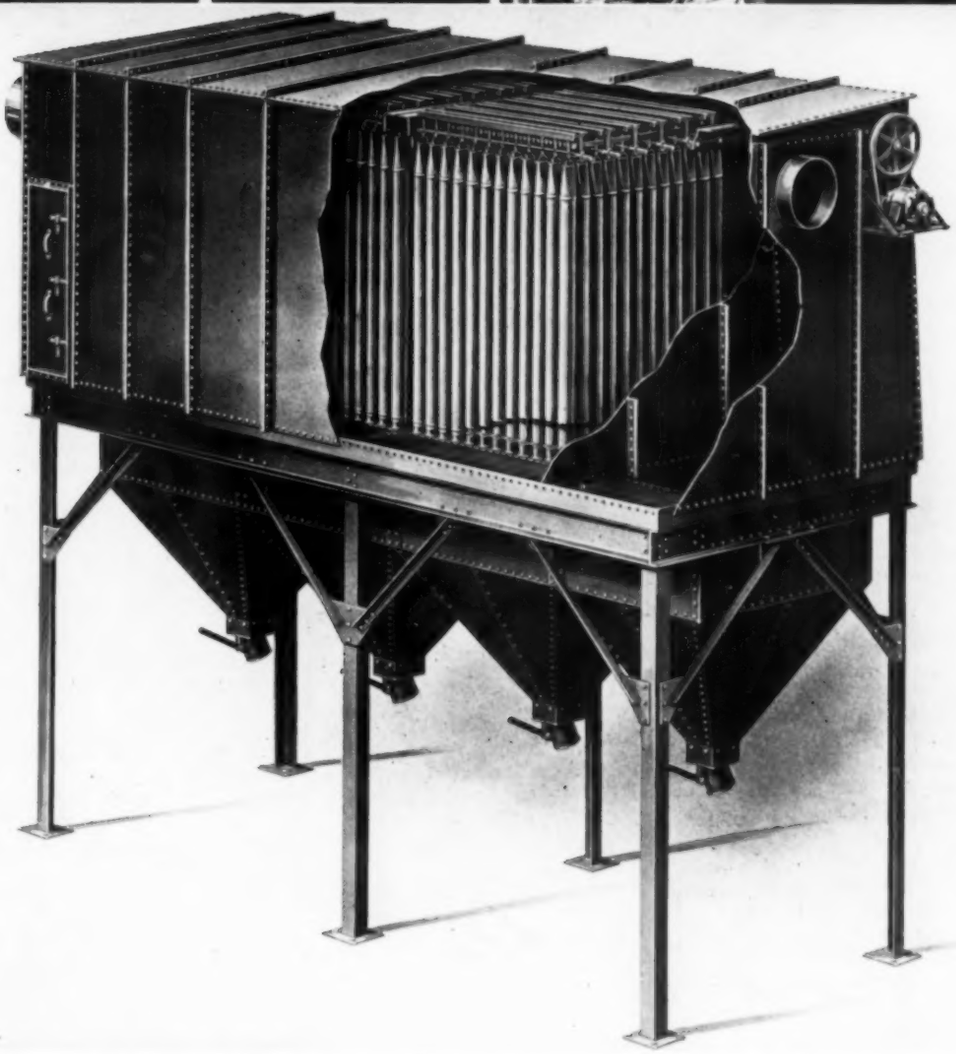
Materials of Industry, by Samuel Foster Mersereau, cloth, 541 pages, published by the McGraw-Hill Book Co., New York, and supplied by THE FOUNDRY, Cleveland, for $2.00 plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

This is a revision of a book, written primarily as a text for students in high schools, industrial and vocational schools. The basis of the materials presented is a course developed by the Brooklyn Technical high school over a period of years, and developed particularly to give students a working knowledge of the main facts of industry, including the distribution and production of raw materials, general properties, transportation, conversion into commercial products and economic importance.

The text discusses forest products, nonmetallic materials such as petroleum, asphalt, asbestos, cement, etc.; iron and steel; nonferrous materials, and miscellaneous including rubber, bakelite, paint, varnishes, etc. The section on the production of castings is all too brief, and contains several inaccuracies. The discussion of pouring gives a picture of confusion that in the modern foundry does not exist



(Above). Two typical installations of Whiting cloth-tube filters in foundry service. Standard units enable the filter to be adapted to available space and give a wide range of capacities.



Sectional view of Cloth-Tube Type Filter, showing arrangement of individual tubes. The dust-laden air passes up thru the tubes, leaving the dust on the inside wall of the tube. A motor-operated shaking device, to which the tubes are fastened by springs, snaps and shakes the tubes, allowing dust to fall into hopper below.

Effective Dust Removal at Low Cost—

That's the keynote of the Whiting Cloth-Tube Filter. One of our first installations of this type has been in continuous service over two years without replacing a single tube.

More and more foundries are recognizing the advantages and economy of dust filter equipment that will give uninterrupted service at a minimum of cost. A large foundry in the South made an exhaustive study of all types of dust-collecting equipment and finally selected the Whiting cloth-tube type. As a typical foundryman describes it, this filter has the "guts."

We'll be glad to give you the whole story or have an engineer make a study of your problem. *Send now for Bulletin 194.*

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15607 Lathrop Ave., Harvey, Ill.

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Electric Traveling Cranes—Cupolas—Cupola Chargers—Brackelsberg Furnaces—Air Furnaces—Steel Converters—Ladles—Quick-Anneal Ovens—Tumbling Mills—Stokers for Core Oven Firing—Pulverized Coal Equipment.

WHITING

PIONEERS SINCE 1884

She learned about foundries from him

The Adventures of BILL

By PAT DWYER

ONE day recently, while standing in front of the foundry exhibit at the Great Lakes Exposition, Bill and I were deeply chagrined to learn that our conception of foundries and foundry practice was hopelessly outdated. Apparently we have been asleep at the switch all these years and while we peacefully slumbered in ignorance the foundry has adopted a new—and to us—a startling technique.

"Take a look at me," said Bill. "Old Bill Rip Van Winkle, himself. All I need is the long bush, the dog Schneider and a few empty beer kegs."

"Not so loud," I shushed him—there's a nice word you don't see very often—"Not so loud. I don't want to lose any of the gems of wisdom, the sparkling bubbles of information gushing so spontaneously from this animated fountain—don't look around for a minute—about two paces to the right."

The animated fountain was a dapper youth in a smooth olive green suit all pleats and ruffles with about 10 square inches of brilliant red handkerchief sticking out of the upper left breast pocket. The manner in which the pocket was attached to the main structure called up visions of the old red barn, a place I have not seen since I was a boy. I was rather startled to find how sharp and clear on memory's screen the martins skimmed in the twilight and darted into and out of their mud nests plastered under the eaves. I could see myself a wicked little barbarian climbing a ladder to rob a nest, delicate and beautiful little white eggs dusted with pink spots. Pull up, pull up, my boy. This is no place for the old sentimental drivel.

The chatty young lad in the pleated suit with the martin pockets and brilliant red handkerchief drew slowly on a cigaret between what might be described as paragraphs. After each period the words and the smoke poured forth in a torrent through nostrils and mouth. Clouds of smoke obscuring the slight fungoid growth on the upper lip led me to wonder if perhaps one was the result of the other. Bill did not think so.

"I know what you have in mind," he said. "Smoke and fumes from blast furnaces and other smelters will kill every blade of grass, every tree and all other vegetation in the adjoining territory, but that rule does not apply to Tim the boy orator on your right. That light, fuzzy excrescence on the upper lip corresponds to the down on a chicken when it first emerges from the shell. It is simply a symbol of youth, all knowing confident youth and will be removed when the wearer arrives at years of discretion. Then he will laugh at the innocent vanity of other youths, even as we in our senile superiority are now snickering discreetly up our sleeve at him."

Just a clean little bit of fun

Fortunately the young man was sublimely unconscious of the presence of the two old broken down wrecks, or for that matter of any other person in the vicinity with the exception of a charming young damsel who clung to his free arm and apparently followed his description with the most flattering attention.

"Look at her," Bill muttered in grudging admiration, "apparently lapping up every precious word when as a plain matter of fact the stream flows in through one dainty ear covered by the hat, and out through the other, uncovered probably for that very purpose. She is either (a) mentally reviewing the events of last night's dance or (b) deciding what she will order for lunch at the Admiralty club as soon as she diplomatically can drag her escort away from these tiresome—ho, hum—exhibits. I think it is a kind of gift. You meet a man once in a while, a weasely dodger, usually holding or trying to grab a public office of some kind, who can put on this pretending to listen act, but women seem to come by the gift as part of their natural evolution and are as proficient at sixteen as they are at sixty.

"Recently I fluttered through a few pages of a book dealing with the life and adventures of a lady author who had considerable experience on the lecture platform. Before one appearance in San Francisco she had gone shopping and by a rare stroke of good fortune had secured a perfectly stunning gown. One page given over to intimate description of the gown. On the afternoon of the lecture before a women's club she had a splitting headache and in general felt decidedly below her usual buoyant par. She struggled through the lecture and realized that

(*Continued on Page* 59)

(*Continued from page* 56)

in many respects it was probably the most unsatisfactory performance of her entire career. 'However,' she commented smugly, 'I do not think it made any difference. The ladies were so intrigued with my gown, that I do not think they paid any attention to what I said or how I said it.' "

"Thrilling stuff," I admitted. "Did the lady have any further adventures?"

"Search me," said Bill. "I threw the book away. A little tripe goes a long way. Kind of edge up a little closer. I don't want to miss any more of the present lecture."

According to the expert this here now foundry business was kind of simple and yet not quite so simple if you get what I mean. He had himself personally spent half a day in a foundry collecting data and all that kind of stuff for local color in a story he intended to sell to one of the slicks. Up to the present none of the slicks had snapped at it and he had a good mind—he had not actually arrived at the drastic decision—but he had a good mind to send it to one of the pulps. Too good for 'em of course and the rate of remuneration was a positive disgrace, but what can you expect with all these amateur writers cluttering up the mails with their junk and spoiling the market for craftsmen like him.

However, what he started to say was a foundry was an awfully hard place in which to get any information. That is really authentic information. For instance he had asked one fellow what he called that stuff in which the molds were made. The fellow brazenly had stated that it was green sand. He thought at first the fellow was jesting. Later in an effort to check up on the point he had asked several men the same question. The answer had been different in every case. One man said old sand, another floor sand, while still another said facing. Up to that time he never had any reason to doubt the evidence of his own eyes and the stuff he saw certainly was black. Thinking possibly that the dim light in the foundry might be a factor, he had examined a mound of the material in the storage yard on the outside and to his astonishment discovered that it was yellow. Inquiry from a passing workman elicited the information that this material was new sand. Reminded him of the old classic description of how to distinguish ripe from unripe blackberries, "When blackberries are red they are green, or to put it another way, green blackberries are red!"

In one corner of the foundry he had discovered a man playing a hose on a great heap of the stuff, hot and dried almost to dust and was told that the man was preparing a batch of dry sand. Can you beat that? Spilling water on dust to make dry sand out of it. They had the same peculiar mental twist in describing temperatures. He heard one man tell another that the metal was too cold. It froze in the gates. This was so palpably impossible that he had touched the metal with his finger and had been severely burned. His startled yelp of pain and astonishment instead of arousing sympathy was greeted with grins of coarse merriment. One rude fellow stuck his finger in his mouth, danced around on one foot and grimaced horribly as one in extreme agony. Another advanced solemnly, struck the offending piece of iron with a great hammer and said, "Naughty, naughty! Didum bad old iron burn ittie bittie Willie's ittie finger?"

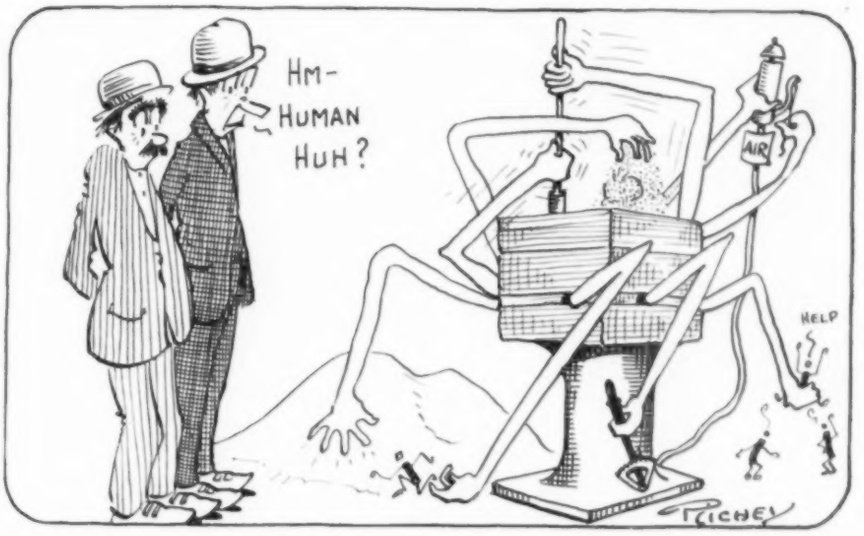
This same spirit of levity, a sly method of maintaining the secrecy of their operations, was shown in the answer he received from a man passing sand through a circular wooden device with a screen in the bottom. He had asked the man quite civilly "Would you mind telling me, my good man, what is the name of that device?" The man paused momentarily in his semi-squatting position and squirted tobacco juice over the crook of his left elbow.

"This here thing? Well, podner seein' as how its you an' on the un'erstandin' that the dope don't go no furder, I don't mind tellin' you in strict confidence that this here thing which I now hold firmly as you observe in both hands, is nothin' more nor less than a riddle. An' what do you know about that?"

Our hero replied haughtily that he had no time to waste in attempting to solve riddles. If the device had a name he should be glad to learn what it was. Otherwise he would be on his way. The low fellow simply shrugged his shoulders and remarked "Ah, nuts!"

Finally he decided to ask no further questions. The employes either had no definite list of proper terms, or they deliberately were conspiring to make his work as difficult as possible. Probably the latter. Witness the childish evasion in proposing a riddle for his consideration.

He devoted the remainder of his time to a keen observation and analysis of the various operations and he rather flattered himself that he had secured a comprehensive knowledge of the materials, methods, equipment and technique employed in the foundry.



Advance model of molding machine does everything but draw a pay check

"Come on," Bill hissed out of the corner of his mouth. "We might just as well yoke the oxen to the cart and start off for home. We have seen the prize exhibit of all time. We might stay here from dawn to dark and roam the Exposition from the bridge of the presidents to the far end of the streets of the world, with the antediluvian monsters and French Casino thrown in for good measure, and never see anything to equal a brilliant young gent who modestly admits that he mastered the foundry technique from *A* to *Z* in one single half day. I have seen second year apprentices occasionally suffering from delusions of grandeur and have heard some astounding claims made by knights of the road when properly pickled in congenial company, but without doubt this one half day performer holds all records, native and foreign, including the Scandinavian."

"Let the oxen graze for a few minutes. The magician may have a few more tricks up the sleeve of that trick coat. Listen."

He rapidly pulled them out. In

some of the more old fashioned foundries the workmen hew pieces of wood to the desired shape and either bury them in holes in the floor or cover them with sand in crates. They keep this up all day until the time for the melt. Then another gang of men comes along with huge pots of liquid metal. Each mold is provided with an opening on the top something like a rat hole. The metal is poured down these rat holes and the heat is so great that it burns all the wood away and fills the cavity. The next day when the metal has cooled the molders dig the castings out with shovels and hoes and things. In the later and more progressive foundries all the work is done by machinery. Containers filled with sand move on a conveyor past a power press which stamps the impression of the desired casting in the sand.

"How would it be," I asked Bill, "if we were to report this to the proper committee with a view of having the apostle of the new deal deliver a coffee talk at one of our chapter meetings?"

"The place for that bird," Bill growled, "is down the Midway at the Old Globe Theater. The play? Har, har, *Love's Labor Lost!*"

Chapter Committees Are Named

E. L. Clair, general superintendent, Toledo furnace, Interlake Iron Corp., was the principal speaker at the first dinner meeting of the St. Louis Chapter of the American Foundrymen's association, held Sept. 10. Mr. Clair presented an interesting discussion of blast furnace operation, indicating the progress that has been made in the solution of annealing trouble, cracks, hard spots and kindred foundry difficulties.

Appointment of the following committees was announced: *Membership;* Francis O'Hare, chairman; R. Durkan; R. Stifel; Walter Zeis and Roy Jacobsen. *Program:* L. J. Desparois, chairman; C. R. Culling; W. Kammerer; and F. C. Hamlin. *Entertainment:* M. A. Bell, chairman; Harry Sanders and E. Goerger. *Apprentice Training:* C. R. Culling, chairman; H. Goodwin; Ralph Hill and J. Shive. John W. Kelin is secretary treasurer of the chapter.

The American Welding Society will hold its seventeenth annual meeting, Oct. 19-23 in Cleveland. Headquarters for technical sessions and committee meetings will be held at the Cleveland hotel.

Finish Program for Iowa Conference

Engineering college of the University of Iowa, Iowa City, Iowa, the Quad-City Chapter of the American Foundrymen's association, and the Northern Iowa Foundrymen's association, have joined in inviting all interested to the foundry conference to be held at Iowa City, Oct. 30 and 31. The conference is being held to bring foundrymen of the district together to discuss the fundamental, practical problems in foundry practice.

An interesting program has been arranged by the following committee: A. V. O'Brien, University of Iowa, Iowa City; Iowa; T. J. Frank, Frank Foundries Corp., Davenport, Iowa; E. A. Gullberg, Deere & Co., Moline, Ill.; J. Morgan Johnson, secretary, Quad-City Chapter of A.F.A., Moline, Ill.; W. E. Robinson, Headford Bros. & Hitchens Foundry, Waterloo, Iowa; Earl W. Manning, Manning Pattern Co., Waterloo, Iowa; and R. E. Kennedy, American Foundrymen's association, Chicago.

The following program has been arranged:

Friday, Oct. 30

9:00 a.m. *Registration*

9:30 a.m. *Opening Meeting*—Address of Welcome

10:00 a.m. *Sand Control*
Horace Deane, Deere & Co., Moline, Ill.
H. D. Dietert, Harry W. Dietert Co., Detroit

11:30 a.m. *Demonstration of Sand Control Methods*
H. W. Dietert

12:30 p.m. *Luncheon*

2:00 p.m. *Fundamentals of Testing Cast Metals*
Prof. H. L. Daasch, Iowa State College, Ames, Iowa

3:00 p.m. *Demonstration of Testing Cast Metals*
Staff, University of Iowa

3:30 p.m. *Cupola Practice*
Fred J. Walls, International Nickel Co., New York
E. K. Smith, Electro Metallurgical Co., Detroit
V. A. Crosby, Climax Molybdenum Co., Detroit

7:00 p.m. *Dinner*

Saturday, Oct. 31

8:30 a.m. *Alloy Cast Iron*
R. G. McElwee, Vanadium Corp. of America, Detroit
F. J. Walls, International Nickel Co., New York
E. K. Smith, Electro Metallurgical Co., Detroit
V. A. Crosby, Climax Molybdenum Co., Detroit

8:30 a.m. *Nonferrous Foundry Practice*
D. M. Curry, International Nickel Co., New York

10:00 a.m. *Electric Furnace and Rotary Furnace Melting of Cast Iron*
W. R. Jennings, John Deere Tractor Co., Waterloo, Iowa
R. G. McElwee, Vanadium Corp. of America, Detroit
D. J. Reese, Whiting Corp., Harvey, Ill.

Inspection of Engineering buildings and campus

Golf—University 18-Hole Course

Talks on Castings At Buffalo

H. A. Schwartz, National Malleable & Steel Casting Co., Cleveland, addressed the Buffalo chapter of the American Society for Metals at the opening meeting of the season, Sept. 17, on "Ferrous Castings."

The speaker traced the metallographic relations of cast iron, malleable iron and steel and showed in general that they all are to be considered as representative of alloys of iron and carbon. They may differ in the amount of total carbon, presence of or absence of graphite and metallographic characteristics of the matrix. Graphite may be flaky, primary graphite or nodular secondary graphite according as it is formed during freezing or during subsequent heat treatment.

The relation of heat treatment and chemical composition to these variables was discussed and some reference was made to the newer graphitizable steels which are noneutectiferous but capable of graphitization, to destroy proeutectoid cementite by heat treatment and contain significant amounts of graphitizing accelerators.

Book Review

Traffic Dictionary, by C. S. Nelson and George T. Stufflebeam, fabricoid, 224 pages, 4½ x 6¼ inches, published by Shipping Service Organization, New York, and supplied by THE FOUNDRY, Cleveland, for $1.25 and in Europe by the Penton Publishing Co. Ltd., London.

This dictionary briefly presents the names and kinds of organizations, publications, documents, equipment and services employed in the preparation, recording and handling of shipments by rail, water, air, express, parcel post and motor truck. The publication also covers warehousing, terminal and transfer facilities, claim procedure, practice before the Interstate Commerce commission, export and import trade transactions, and transportation legislation, rules and regulations.

This is the second edition which has been corrected and brought up-to-date.

In this
BARTLETT-SNOW
equipped

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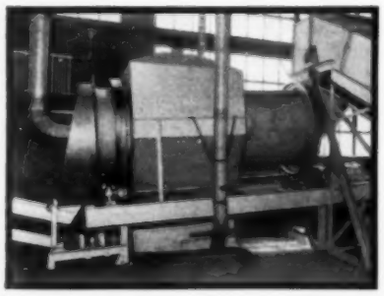

BARTLETT-SNOW REVOLVING SCREENS . . . dust tight . . . for overhead or floor mounting. Seven sizes are shop standard—others to meet any requirement.

BULLETIN No. 75. Complete with 120 illustrations and 26 engineering diagrams, this 44-page booklet describes the Bartlett-Snow method of securing less costly; more efficient operation. Send for one!

. . . molds are made along the side wall with Bartlett-Snow flask fillers . . . poured with the traveling crane that brings hot metal to them . . . and shaken out in a central shakeout hopper. Sand is removed from the shakeout hopper with an apron conveyor . . . passed through a revolving breaker screen . . . then over a magnetic pulley. Old sand is conditioned overhead—mixed with new sand in definite amounts—pugged and aerated, and fed back to the hoppers that need replenishing with a belt distributing system.

Complete with new sand inlet and storage hoppers . . . and definite capacity feeders . . . this plant was designed from the blue prints up—a typical Bartlett-Snow procedure—specially to meet an existing problem. It is but one of many outstandingly successful applications of Bartlett-Snow equipment to foundries casting large and heavy work . . . forecasts, the efficient and painstaking application of mechanical methods to your problem, when like other foundrymen, you refer your problems to the Bartlett-Snow foundry engineers. What are your problems?

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SAND HANDLING AND SAND CONDITIONING EQUIPMENT
MOLD CONVEYORS AND ACCESSORY FOUNDRY EQUIPMENT

Dirt Causes Cylinder Trouble

Hard Core or Sand Washing From the Gate May Result in Defects in Bottom of Bore

IN SOME instances the cause of a defective casting is fairly obvious, while in others, the conclusion is not arrived at so readily. Overlooking a single factor in the evidence submitted may lead to an erroneous decision. For example consider an apparently satisfactory gas engine cylinder casting which develops dirty or porous areas on the lower, or drag side of the bore after the first cut in the machine shop.

Blow holes or cavities in a casting—outside of readily recognizable shrinkage cavities—are due to gas or steam arising from faulty molding or coremaking processes or materials. Certain cavities also may be traced to oxidized iron, but they also have a characteristic appearance. In addition this form of defect will manifest itself all through the casting and will not be confined to the area in the lower side of the bore.

Core Is Responsible

Usually the jacket core is responsible for the trouble. The vent does not escape readily from this core, or more properly speaking it does not escape through the vent channels provided for the purpose. In ordinary foundry parlance the iron *boils* away from the upper surface of the lower part of the jacket core. Some of this excess gas is carried upward with the rising iron and escapes through the sand or through the risers. A certain amount is trapped in the form of bubbles as the iron jumps against the cold undersurface of the main core. In extremely impermeable jacket cores these bubbles will be found also in that part of the casting which comes in contact with the highest part of the core.

The point cannot be stressed too strongly that the jacket core must be made in a manner that will not cause the least bit of disturbance. The iron must lie against it *dead*. To this end the core must be made entirely of sharp sand bonded with a minimum amount of oil and baked almost to the burning point. The object, of course, is to produce a highly permeable core containing a minimum amount of gas producing material. To this end also the sand must not be rammed hard. In some instances it is necessary to introduce wax vents in the core, but in many instances the venting can be accomplished with a suitable number of vent rods introduced when the core is being made and later withdrawn.

Where the coremaker is not fully alive to the necessity of producing a highly permeable core, he will introduce a certain amount of molding sand in the mixture to prevent the core from sagging while in the green state. This should not be allowed. Molding sand in a core sand mixture reduces the permeability. In shops where jacket cores are made on a production basis, the cores are supported on cast iron or aluminum dryer shells. On limited orders a mound of black sand will serve, but the presence of such a large quantity of black sand will retard the drying. Cores made in this manner should be given a second period in the oven after they have been dried sufficiently to remove them from the black sand bed.

Occasionally the bubbles are caused by a hard or poorly vented bottom surface on the main core. However, the theory is not very convincing since in all probability, if the bottom of the core is too hard, the remainder of the core would be in the same condition and as a result the defects would appear all around the bore. The point merely is raised as a possible but remote and therefore, unconsidered factor in some instances. Incidentally, blazing hot iron will not hold the gas as tenaciously as cold iron. The ideal mold or core of course is one which does not cause any commotion in the iron. Where a slight flutter does take place the gas will escape from extremely hot iron, where it will remain trapped in a film formed by cold iron.

The most probable cause of a dirty area in the bottom of the bore is a quantity of foreign material which floats on the iron until it comes in contact with the bottom side of the main core. There it sticks and remains to show up later under the boring tool. Retention of this slushy material in this particular area of the casting is due principally to the fact that the metal does not flow in a current between the jacket core and the main core. The metal in this space is comparatively quiet and simply rises at a corresponding rate with the metal on the outside of the jacket.

A deceptive relief measure would be to gate the casting in such a manner that the metal would flow rapidly past this dangerous area. In some instances the flowing iron would prevent the slush from sticking to the bottom of the main core. Even in these instances the foreign material would be deposited elsewhere in the casting. The precise location would determine whether the defect was sufficient to scrap the casting.

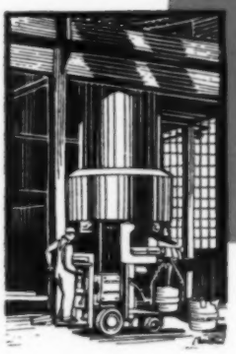
Prevent Slush Formation

The proper procedure is to prevent the formation of this slush in the iron. This material may be sand washed in from the runner basin, or from the walls of the upright runners. It may be a combination of sand and blacking washed from the face of the mold or core either by erosion, or by the action of steam or gas forcing its way through the surface instead of following a passage or passages designed for the purpose in the form of suitable vents. A close examination and a process of elimination will determine which of these factors is responsible in any given instance.

Sand washed from the runner basin or sprues constitutes the most probable cause in nearly all instances. Needless to say the greatest care is necessary in making up the runner basin and in ramming the sand around the gate pins to provide a passage through which the iron will flow quietly.

Where the gas cannot escape readily from the mold or core, it will pass through the skin and cause the metal to boil in the vicinity. This boiling action invariably loosens some of the sand and blacking and this material then floats away until it comes in contact with a cold surface. Here it will stick while the iron flows past to fill the mold.

ADVERTISING PAGES REMOVED



VIEWING FOUNDRY DEVELOPMENTS

At Short Range

APPLICATION of electric heat to metal patterns, according to the experience of several foundries, practically has eliminated trouble from stick-downs. Several methods are available for attaching the heating elements. If the pattern is hollow and attached to a base plate, the element may be placed between the two. Another way is to mount the heaters under a plate which is attached to the molding machine platen to serve any pattern which may be used.

♦ ♦ ♦

A large die for forging one-piece steel tops for automobiles had the following composition: Silicon, 1.35 per cent; manganese, 0.50 per cent; total carbon, 3.40 per cent; nickel, 2.00 per cent, and chromium, 0.20 per cent.

♦ ♦ ♦

Application of molybdenum to zinc plating has resulted in the depositing of zinc in a brilliant, dense and ductile form as compared to a dull, gray, and sometimes porous coating obtained by ordinary procedure.

♦ ♦ ♦

ROLLER housings used in the emergency dam bulkheads of the Bonneville lock and dam weigh 1550 pounds each and are made of cast steel with the following composition: Carbon, 0.24 per cent; manganese, 0.85 per cent; silicon, 0.33 per cent, and nickel, 2.15 per cent. That steel after normalizing at 1650 degrees Fahr., and drawing at 1200 degrees Fahr. has physical properties on the average of 92,160 pounds per square inch ultimate tensile strength; 62,700 pounds per square inch yield point; elongation in 2 inches, 27.5 per cent, and reduction of area, 48.5 per cent.

♦ ♦ ♦

A sand-cast copper alloy has been developed which has a conductivity of 80 per cent, an ultimate strength of 50,000 pounds per square inch and an elastic limit of 25,000 pounds per square inch. Its brinell hardness ranges from 116 to 125 and it has an elongation of 25 per cent in 2 inches. The alloy also has a high fatigue strength and a high creep strength at elevated temperatures.

♦ ♦ ♦

A Florida firm claims to have developed a new bright lead alloy which is resistant to tarnish and the attachment of sea water barnacles, algae and grasses. It is designed primarily as a protective coating on other metals to which it is applied by the hot dip process.

♦ ♦ ♦

NICKEL-COPPER resistance grids containing 45 per cent nickel and 55 per cent copper are poured in sand molds at a temperature ranging from 2460 to 2550 degrees Fahr. Immediately before pouring the alloy is deoxidized and degasified with 10 ounces per 100 pounds of metal of 10 per cent silicon-copper and then with 2 ounces per 100 pounds of 15 per cent phosphor-copper. Sand approximating a No. 2 Albany with a 6 per cent moisture content is used for molding.

♦ ♦ ♦

The alloy containing 95 per cent copper, 4 per cent silicon, and 1 per cent manganese begins to freeze at approximately 1832 degrees Fahr. Consequently, large heavy castings are poured at temperatures ranging from 1950 to 2050 degrees Fahr. Small, light-sectioned castings often are poured advantageously as high as 2250 degrees Fahr.

♦ ♦ ♦

Many of the cast steel, steam line and service valves used in the new cruisers and destroyers being built by the U. S. Navy are made from an alloy containing 0.35 per cent carbon, maximum; 0.50 to 0.70 per cent manganese; 0.20 to 0.45 per cent silicon; 0.04 per cent phosphorus, maximum; 0.04 per cent sulphur, maximum, and 0.40 to 0.60 per cent molybdenum. That alloy develops the following minimum physical properties: Tensile strength 70,000 pounds per square inch; proof stress, 35,000 pounds per square inch; elongation in 2 inches, 20 per cent; reduction of area, 30.0 per cent, and cold bend, 120 degrees around a 1-inch pin.

♦ ♦ ♦

Boron carbide is a convenient source of boron for general metallurgical purposes. It contains 78.22 per cent boron, 21 per cent combined carbon, and 0.78 per cent iron, silicon and other elements. It has been used successfully as a deoxidizer, as an addition to steel required for wear resisting castings, as a constituent in alloy tool steels, and in welding rods used for depositing a hard surfacing alloy.

♦ ♦ ♦

Extreme hardness of an alloy cast iron containing 4.50 per cent nickel and 1.50 per cent chromium prevents boring and machining. However, one pump manufacturer overcame that difficulty by using sections of soft steel tubing of the desired sizes to form the cores at such points. The cores remain in place after the casting is made, and the boring and machining operations are performed on the insert. To insure that the soft steel insert will remain in place a soft steel pin, somewhat longer than the outside diameter of the tube, is placed in a hole drilled through the tube so that it extends through on both sides.

♦ ♦ ♦

WHILE many foundrymen find that the horn gate is advantageous in admitting molten metal to the mold cavity, they often fail to realize that the common arrangement of that gate tends to inject the metal into the mold rather than to provide a quiet entrance. However, if the large end of the horn gate is attached to the mold cavity, the desired results are obtained. In some cases that arrangement may be difficult to accomplish, but no effort should be spared as the benefits are well worthwhile.

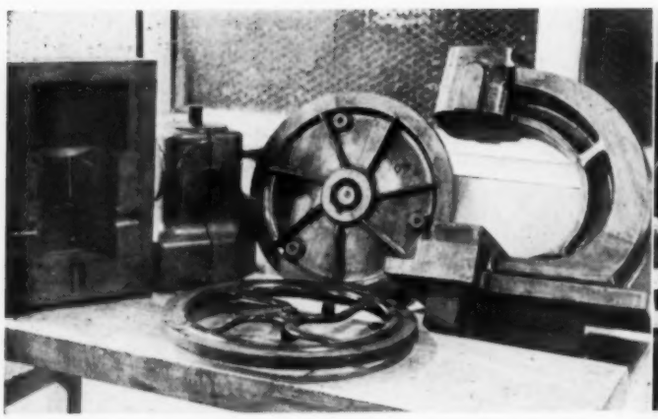


Fig. 1 (Left)—Types of patterns made by the students. Fig. 2 (Right)—Each student is supplied with a full hand tool kit for which he is responsible

Teach Students Patternmaking

By FRED B. JACOBS

ACCORDING to a somewhat popular conception a college workshop is a department where students receive a few hours instruction weekly in manual training of a theoretical character. While it is true that no student can become an expert workman through the approximately 200 hours devoted to the practical work in the average engineering college course, still students at the Case School of Applied Science, Cleveland, are taught mechanical engineering, drawing, patternmaking, molding and machine shop practice along practical lines. Instead of a hazy idea of what it is all about, the graduate has a clear conception of every step in the process of making typical machine parts. The present article outlines briefly methods and equipment in the pattern shop.

Lessons Are Practical

That the lessons are of a highly practical and utilitarian character may be inferred from the group of patterns shown in Fig. 1. These patterns made by the students are used for making castings required in the shops and laboratories. Later when the student sees his brain child performing as part of a mechanical unit he is impressed. Value of knowledge gained in this manner cannot be over estimated.

The pattern at the extreme right in Fig. 1 is for the upper frame of a punch press, 17½ inches high and is split through the center. This type of pattern enables the instructor to point out the advantages and disadvantages of split and solid patterns under varying conditions. Later in the foundry the student is given the opportunity of making molds from both types of patterns. The center pattern standing on edge is for a sanding disk 15½ inches in diameter. Since the web is only 5/16-inch thick and therefore in danger of warping when placed in the damp sand, a number of stopoff strips are attached to the face. After the pattern is withdrawn from the mold the cavities left by these strips are filled with sand.

The pattern lying on the bench is for a hand wheel 13½ inches in diameter and is a good example of student work since the arms had to be worked down to size by hand. The curved arms provided the instructor with the opportunity of describing the strains set up in a casting, particularly of this character while passing through the various temperature ranges.

At the extreme left are the corebox and pattern for a lathe dynamometer. The pattern is 11 inches in height. The corebox serves as an object lesson in explaining the use and advantage of a half corebox under certain conditions. Pairs of half cores made in this box are dried individually and then pasted together to form the complete units.

Various parts of patterns are painted according to the standard color scheme adopted several years ago by the American Foundrymen's association. Thus in later years as a practicing engineer and brought into contact with patterns, the former student will remember that: 1—Surfaces to be left unfinished are painted black. 2—Surfaces to be machined are painted red. 3—Seats of and for loose pieces are painted with red stripes on a yellow background. 4—Core prints and seats for loose core prints are painted yellow. 5—Stopoffs are indicated by diagonal black stripes on a yellow base.

Underlying principles of patternmaking can be taught by theory, but the practical phase of actual pattern construction is more efficacious in giving the student a proper insight. No workman can do good work without proper tools, and this is true to a greater extent in a student body. At Case school the pattern shop is equipped with all the necessary power and hand wood working tools for turning out good work. Equipment includes four wood working lathes, one large bandsaw, one small bandsaw, one large jointer, one small jointer, one disk sander, one drill press, 14 work benches 2 x 5 feet with the front board 34½ inches above the floor, also two layout and assembly benches.

Adequate Equipment Provided

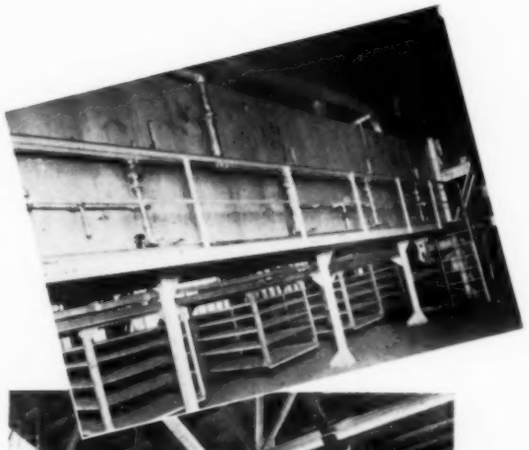
Adequate assortment of hand tools includes a block plane, jack plane, chisels in assorted sizes, etc., all arranged in a neat kit as shown in Fig. 2. The student gets one of these kits on a tool check and is responsible for the tools while they are in his possession. Any other tools he may require, large plane, hand saw, etc., also are issued on check.

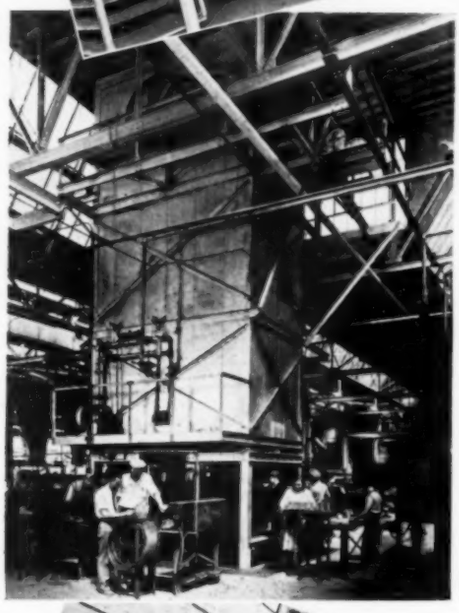
A corner of the class room with several boys at work is shown in Fig. 2. Usually the class includes not more than 15 students, thus affording greater opportunity for individuals to consult the instructor at any time during the class period.

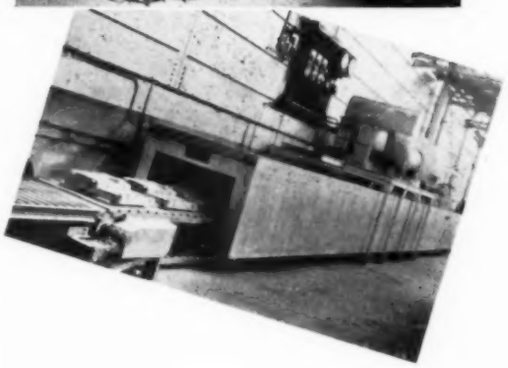
The pattern shop is housed in the Charles William Bingham Mechan-

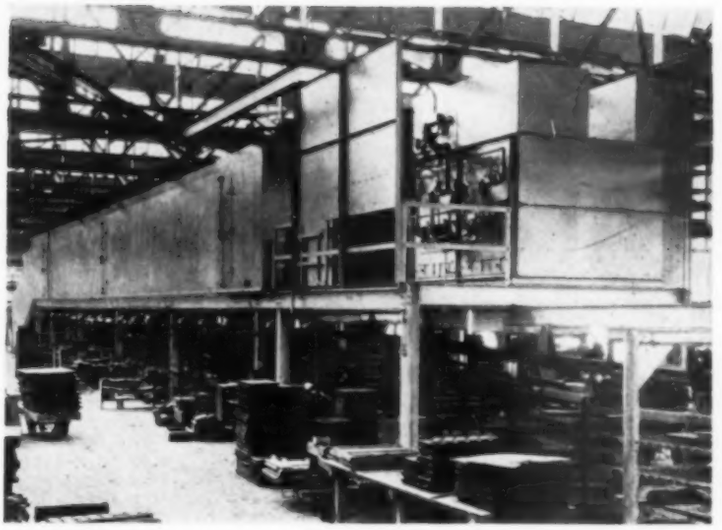
(*Concluded on page* 68)

Coleman Conveyor Core Ovens









Coleman Conveyor Core Ovens have brought "straight-line" production into the core departments of many leading foundries.

Increased production, less floor space, saving in labor, lower fuel cost, better cores, reduced losses and improved working conditions are features that have enabled Coleman Conveyor Ovens to quickly pay for themselves.

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C L E V E L A N D • O H I O

(*Concluded from page* 66)

ical Engineering building, a modern brick and concrete structure and one of the latest additions to the group of buildings on Case campus. Ample daylight is supplied through large steel sash windows. In addition the shop is illuminated by direct overhead light arranged according to latest accepted standards.

One of the first things learned by the student is that wood working tools are sources of danger if not operated properly. Power driven tools, jointer and saws are equipped with accepted standard safeguards and the danger of accident is reduced to a minimum. All the power tools with the exception of three woodworking lathes are motor driven. The lathes are driven from a line shaft. The switch boxes are locked and the keys are in the possession of the instructor. Before a student uses the large jointer or one of the other tools he must have the instructor unlock the switch box. Naturally this gives the instructor the opportunity of discovering what the student intends to do. For example in a typical instance a student wanted to use the jointer for planing the sides of a board approximately 10 inches square. This is a dangerous job to attempt on a jointer, even in the hands of an expert. The instructor explained why a job of this kind should not be done on a jointer. Without the safeguard of a locked switch the student might have gone ahead on his own initiative and possibly have lost a few fingers.

Learns Wood Turning

In Fig. 3 the student is shown taking his first lesson in wood turning. A piece of wood 16 inches in length, 1¾ inches in diameter is mounted between centers and the student is using a gouge. He was shown how to mount the piece in the lathe, how to adjust the tool rest and how to hold the tool with the cutting end always upward so that it cannot become caught in the whirling piece of wood. He is shown that if the cutting end comes in contact with the wood while at an improper angle, the wood may be ruined or even torn from between the lathe centers, or that the tool may be pulled from his grasp. Thus by proceeding slowly and cautiously after receiving instruction he learns the first principles of wood turning. Later he is taught the use of all finishing tools and how to secure various types of surfaces by using chisels and gouges.

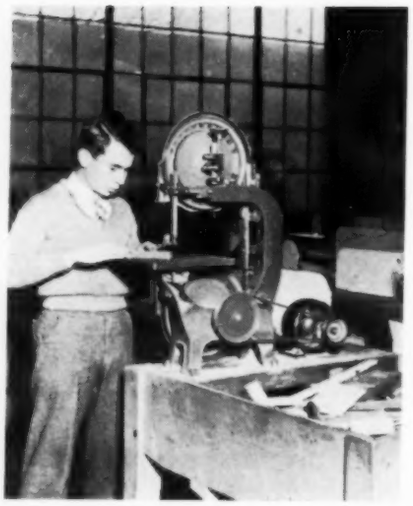

Fig. 5—The student is shown how to get the most out of a bandsaw

In Fig. 4 the student is shown operating a disk sander. He is warned that he must keep his fingers away from the disk or suffer the consequences of lost skin. He is taught that the sander is a labor saving device. For example band sawed pieces of wood can be worked down rapidly and accurately to correct size and shape on the disk sander.

The student shown in Fig. 5 is taking a lesson on the band saw. While, generally speaking, this is not a dangerous tool, the student is shown how to keep his fingers out of the path of the saw blade. Through practice he soon learns to follow accurately the lines laid out on the surface of the wood. Also the fact that this tool saves valuable time over hand sawing is brought to his attention in a practical manner. The saw shown in Fig. 5 is mounted at the end of a bin which contains small pieces of scrap lumber. The student learns to use this scrap whenever possible instead of cutting a new board every time a small piece is wanted.

Practical advantages of this course in patternmaking as briefly outlined are of great value to the student in after life when he finds his place in the busy ranks of industry. He knows something about patterns, because he has made them himself. He knows enough not to design monstrosities that cannot be molded without great difficulty. He knows why it is necessary to use dry sand cores, why loose pieces on a pattern facilitate the molding of certain shapes, why certain patterns should be split, the use of follow boards and matchplates. He learns these and many other facts through practical application and instruction under competent supervision and the effects of lessons learned in this manner will endure throughout his active career.

Development of Draft Gears

Engineering experiment station, Purdue university, Lafayette, Ind., recently has published a 150-page bulletin entitled "Development of Draft Gears for American Freight Cars," by William E. Gray and C. W. Messersmith. The bulletin reviews literature published during the past 40 or more years on developments which have led to the modern freight service draft gear which is supplemented by data by manufacturers engaged in making draft gears.

Fig. 3 (Left)—Students progress through all the stages of wood turning. Fig. 4 (Right)—Several machines are equipped with motor drive and the operating parts are guarded

ADVERTISING PAGES REMOVED

Foundry Talks Heard At Quad Cities

The first regular fall meeting of the Quad-City Chapter of the American Foundrymen's association was held at the Fort Armstrong hotel in Rock Island, Ill., Sept. 21. T. J. Frank, chairman of the chapter, presided and approximately 90 members attended, with many visitors coming from surrounding towns and cities.

Rex Jennings, foundry superintendent, John Deere Tractor Works, Waterloo, Iowa, featured the evening's program by an interesting talk on "The Foundry of Today." He discussed the progress of various foundries in different fields, stating that it was difficult to point out the ideal foundry of today because of the progress being made in the varied stages of operation, etc. Mr. Jennings pointed out the important changes that have come about in the manufacture of better castings. In this connection, he stated that service was now available, through experts to solve problems of both large and small plants. The human element was emphasized by the speaker as of importance in the mechanization of the industry, including the training of foremen and workers.

Announcement was made of the foundry course to be held at Iowa State university, Oct. 30 and 31, under the auspices of the university and through the co-operation of the A.F.A. and local organizations of foundrymen in Waterloo, Iowa and the Quad-cities. The next meeting of the Quad-City chapter will be held at the Blackhawk hotel, Davenport, Iowa, Oct. 19.

Acetylene Meeting

International Acetylene association will hold its thirty-seventh annual convention in St. Louis at the Jefferson hotel, Nov. 18, 19 and 20. Technical sessions will be held two evenings and each afternoon, at which the oxy-acetylene process for welding and cutting metals will be featured.

Book Review

Construction and Operation of the Cupola (Der Bau und der Betrieb der Kupolofen), by L. Schmid, paper, 132 pages, 6¼ x 9¼ inches, published by Wilhelm Knapp, Halle (Saale), Germany and supplied by THE FOUNDRY, Cleveland, and in London by the Penton Publishing Co. Ltd., 314-17 Caxton House, Westminster.

This volume which is part 20 of a series on works practice in iron, steel and metal foundries, edited by Hubert Hermanns, is divided into two sections. Section one deals with the construction while other not as yet available, will deal with the operation. Section one is divided into two parts of which the first relates the development of cupola melting technique, and includes information on the development of pig iron manufacture, the first melting furnace, and the development of cupolas during the nineteenth century up to the present time. Part two describes the construction of the regulation cupola, giving details on stack diameter, shape, and lining; blowers and blast piping; devices for conducting the gases, fumes, sparks, etc. away; charging apparatus; opening and botting up the tap hole; forehearths; baby cupolas and large cupolas; hot blast cupolas, and cupolas fired by pulverized fuel, liquid fuel, and gas fuel. The publication is written in German.

Bibliography Covers Sand Testing

American Foundrymen's association, 222 West Adams street, Chicago, recently has made available a 6-page mimeographed bulletin comprising a bibliography on sand testing and control which lists various reports and papers appearing in the *Transactions* of the association from 1923 through 1936.

Re-elects Officers

Porcelain Enamel institute, Chicago, re-elected the following officers for 1937 at the association's meeting, held Oct. 1 and 2 at the Hotel Statler, Cleveland: Robert G. Calton, vice president of the Tennessee Enamel Mfg. Co., Nashville, Tenn., president; Emery L. Lasier, vice president of Titanium Alloy Mfg. Co., Niagara Falls, N. Y., vice president; Frank E. Hodek Jr., secretary-treasurer of the General Porcelain Enamel & Mfg. Co., Chicago, vice president; William Hogenson, president of the Chicago Vitreous Enamel Product Co., Cicero, Ill., treasurer and George P. MacKnight, Porcelain Enamel institute, Chicago, secretary.

Detroit Plays Golf

A golf tournament on Sept. 17 inaugurated the fall season for the Detroit Chapter of the American Foundrymen's association. Held at the Pine Lake country club, this opening event of the year was followed by a dinner and meeting. R. B. Crawford, Atlas Foundry Co., Detroit, was in charge of arrangements.

Cleveland Firm Host To Ohio Chapter

The Northeastern Ohio chapter of the American Foundrymen's association spent an interesting afternoon and evening, Oct. 8, at the plant of the Westinghouse Electric & Mfg. Co., Cleveland. The program included a plant visit, a short talk, dinner, a motion picture and a paper by William B. Wallis, president, Pittsburgh Lectromelt Furnace Corp., Pittsburgh.

B. G. Parker, Youngstown Foundry & Machine Co., Youngstown, O., chapter vice president, acted as technical chairman and presented Mr. Wallis. Speaking on "Electro Melting and Duplexing of Iron and Steel," Mr. Wallis directed his talk principally toward the application of the electric furnace to the gray iron foundry. He prefaced his remarks by a brief historical reference to the use of the cupola, open hearth, the advent of the first iron casting and the arrival of the electric furnace. Improvement in the metallurgy of gray iron was discussed.

An outline of the uses, application and requirements of the electric furnace followed. In this connection it was stated that there are four main uses for this type of furnace: Continuous cold melting; batch melting; duplexing; and triplexing, which is a combination of the previously mentioned. Mr. Wallis then discussed the various charges and combinations in which the electric furnace may be used and the conditions surrounding its use. Advantages of this unit were pointed out by the speaker.

F. C. Winkler, chief designing engineer on commercial and industrial lighting, gave a brief talk and demonstration covering the subject of modern lighting. Mr. Winkler discussed the use of the human eye, strain to which it is subjected, modern illumination and how the Westinghouse company is attempting to correct and improve the conditions in foundry and other types of plants. Practical tests were given as illustration.

The entire group of men, numbering over 200, made a tour of the Westinghouse plant in the afternoon. The next meeting of the chapter, to be held at the Cleveland club on Nov. 12, will feature a talk by H. J. Rowe, Aluminum Co. of America, Cleveland, on "Aluminum Foundry Practice."

Moves Offices

Parsons Engineering Co. has removed from 2035 West 105 street to 2611 Cedar avenue, Cleveland, where larger quarters are available for increased manufacturing.

Producing Brake Drums

(*Concluded from page* 23)

circular runner were not used there would be a possibility of the metal solidifying too rapidly in its progress through the mold, or the temperature undergoing too great a change to produce a good casting. Pouring temperature of the metal is approximately 2750 degrees Fahr. and a close relationship between the adjoining parts is brought about by the procedure mentioned. The casting weighs 14 pounds with the steel plate, 11½-pounds finished and requires machining with specific accuracy to within a fraction of an ounce.

Handling Equipment Is Aid

An overhead traveling crane and tramrail, operated by one man and having an easy access to the cupola in the eastern bay of the foundry, carries metal in the ladle to the pouring stand where it is lowered by chain arrangement to the pourers, as may be seen in Fig. 1. Immediately after the castings have solidified, the molds travel to the shakeout where they are dumped, the castings are loaded in trucks or carriers for transportation to the cleaning room and the flasks are put on the conveyor and returned to the vicinity of the molding machines.

As a further aid to production, materials handling facilities have been brought to a fine degree of efficiency. Sand drops from the shakeout through a grating to the lower floor belt conveyor built by the Link-Belt Co., Chicago. This belt also catches miscellaneous sand from the individual molding machines on the main floor. Passing through a screen, the sand travels up a slight incline and goes through another screen to a separator which removes lumps and foreign material. A continuous bucket elevator conveys the sand to the floor above the molding machines where it travels on a wide belt to two 45-ton storage hoppers. Dropping by gravity through these, it falls on a belt leading to a revivifier. As it goes from the hopper to the revivifier, the sand is wetted down and tempered by several streams of water. From the revivifier it is carried by belt to the openings above a series of bins arranged in line over the battery of molding machines, as shown in Fig. 1. Each of these bins or chutes is equipped with a hand-controlled gate at the bottom. When the molder opens this gate, the correct amount of sand falls by gravity into the flask mounted on the molding machine.

Sand used in the production of the brake drum molds has a permeability ranging from 35 to 45, moisture content from 6 to 6½ per cent, compression strength is approximately 6 pounds as determined by shear test and artificial bond an average of 2½ to 3 per cent. Instead of facing the molds with a special mixture, coal dust is added to the entire sand supply at the discretion of an experienced operator. Thus the sand becomes automatically both facing and backing sand. Approximately 40

Fig. 4—Cope is placed in position on the drag and steel plate

pounds of sand is used for each half.

Routine testing of the sand is conducted in the laboratory at intervals during the day, an experienced operator attending the mixing stations. Since all castings are shaken out al most immediately after solidifying, there is little burning of the sand and only a small part of the moisture is evaporated. This does away with the necessity for continual adding of new sand or other bonding agents required to restore the desired properties to the sand. Adjustment of the bond, permeability, grain size, etc. is effected from time to time by the addition of measured quantities of new sand or clay.

Plan New Research

The division of research associates at Battelle Memorial institute was inaugurated Sept. 1 when four research associates started their work under the general direction of Dr. Oscar E. Harder, assistant director. The purpose of this new division is to supplement the work of the technical staff in fundamental research. To that end, Alfred Clark, has been assigned a research project on problems in chemistry; John E. Dorn, in metallurgy; Robert P. Graham, in ceramics; and L. G. Turnbull in industrial physics.

Ferroalloys Feature Eastern Meeting

August and September were featured by a mid-summer outing and a regular monthly meeting respectively, for members of the New England Foundrymen's association. The group met at North Scituate, R. I., on Aug. 12 for a wide selection of games and sports, a dinner and an interesting evening's entertainment arranged by George C. Hagstrom and Charles Colvin. The regular monthly assembly of the association was held Sept. 9 at the Engineer's club, Boston, and included dinner and a talk by John N. Ludwig Jr., metallurgist, Electro-Metallurgical Corp., New York.

Mr. Ludwig spoke on "Ferroalloys in the Foundry." He pointed out the value to foundrymen of ferrosilicon, ferromanganese, ferrochrome, ferrovanadium, ferromolybdenum, and other less widely known alloys, in the maintenance of quality and engineering requirements for improvement and specialized service in gray iron castings. The use of various types and grades of ferroalloys, proper methods of their introduction and the particular advantages of briquetted ferroalloys were discussed.

E. H. Cooley, manager, Massachusetts Fisheries Association Inc., spoke on "The Fishing Industry" immediately following dinner, as a short coffee talk.

Book Review

Architectural Drawing and Detailing, by J. Ralph Dalzell and James McKinney, cloth, 212 pages, published by the American Technical Society, Chicago, and supplied by THE FOUNDRY, Cleveland, for $2.00 plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

The purpose of this book is to present the general principles, practices and techniques of architectural drawing, detailing, rendering in pen and ink, and landscaping.

The presentation has been prepared as a text to serve beginning students, laymen or draftsmen. The general presentation includes a discussion of each principle, followed by simple and thorough directions for procedure. The text is well illustrated with both pictorial and standard drawings to aid greatly in visualizing details. Exercise problems and an extensive index are included.

Paper Makers Chemical Corp., Lockport, N. Y., has introduced a new line of foundry supplies including core oils, core paste, core wash, etc.

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Hold Foundry Congress

(*Concluded from page* 34)

burg, a number of foundries were visited. A limited number of members visited the Krupp works at Essen.

The technical sessions were held near the exposition grounds on the mornings of Sept. 18, 19 and 20. Thirty-two papers were contributed to the meeting, including exchange papers from the American Foundrymen's association, the Institute of British Foundrymen, the Association Technique de Fonderie of France, the Association Technique de Fonderie of Belgium, the Czech association, the Polish association, the Association of Italian Founders and the Austrian foundry association. The American exchange paper "Studies of Casting Stresses in Chilled Iron Rolls" was by J. Erler, chief metallurgist, Farrell-Birmingham Co. Inc., Ansonia, Conn.

Compare Test Methods

Thursday afternoon, Sept. 17, the International Committee for Cast Iron Testing Methods held its meeting. Vincent Delport, representing W. H. Spencer, the American delegate, attended on behalf of the American Foundrymen's association. Thomas W. Pangborn, president, Pangborn Corp., Hagerstown, Md., also was present. At 6:30 p. m. the International Committee of Foundry Technical Associations held its annual meeting with J. Leonard, president, in the chair. The American Foundrymen's association was represented by Thomas W. Pangborn, head of the American delegation and by Vincent Delport, European representative, who was elected president of the International Committee for the year 1937.

During the afternoon many opportunities were given to visit several of the most typical foundries of the Ruhr district and to re-visit the exhibition. Local and neighboring places of interest could also be seen and a special program was arranged for the ladies. A special mention should be made of the visit to the Kaiser Wilhelm institute, which is said to be one of most modern and complete metallurgical laboratories in existence.

On Monday, Sept. 21, the delegates left Dusseldorf for a three-day trip, mostly done in fast motor-coaches. Several works were inspected during the journey, and an opportunity was given to experience the Reichsautobahn, special road constructed for automobiles, which are probably the finest in Europe.

Thursday, Sept. 24, the members arrived in Berlin and in the evening they were officially received by the City Corporation in the town hall. The next day was devoted to a sightseeing tower of Berlin and Potsdam, and the official banquet was held in the evening. Saturday, Sept. 26, a number of members started on a further post-convention tour through Dresden, Nuernberg, Munich, Stuttgart, Heidelberg, Durlach and Coblenz. During this journey through some of the most beautiful country in Germany, more opportunities were given to inspect foundries and various other works.

The American delegation to the congress comprised Mr. and Mrs. Thomas W. Pangborn, G. W. Cannon, Mr. and Mrs. Henry Held, Mr. and Mrs. Edward G. Borgnis and Vincent Delport. They were greatly impressed by the general arrangement of the Congress, by the works they had visited, and by the very fine exhibition.

A summary of the principal papers and further details relative to the exhibition will be published in the November issue of The Foundry.

Methods of Making Paper Rolls

Questions covering the manufacture of castings used in the paper making industry and known as dryer shells usually include the following: 1—Analysis of the metal and if nickel and chromium are used. 2—Are the rolls molded and cast on end. 3—How are they gated. 4—Are the cores made in loam or dry sand, in one piece or in sections. 5—What kind of pattern is employed. 6—What is the average thickness of cast iron flask. 7—Thickness of sand between pattern and flask.

Dryer shells for paper mills are made in a great variety of sizes and the practice varies to some extent in different foundries. Most of the castings are made in dry sand molds, but the largest sizes usually are made in loam molds. Taking the questions in the order presented: 1—The castings range in thickness from ¾ to 1½ inches and the analysis corresponds to that usually employed for good machinery castings of the same metal thickness. The face of the casting is machined all over and polished, therefore the iron must be clean and close grained. Typical analysis for a shell with a metal thickness of 1 inch would show: Silicon 2.00 per cent, manganese 0.70 per cent, sulphur 0.07 per cent, phosphorus 0.40 per cent. Many roll makers favor the addition of 10 to 25 per cent charcoal iron, while others add the same amount of steel scrap to the mixture. Nickel and chromium are desirable agents in any casting where strength and a high finish are desired, but the amounts will vary with the thickness of the casting and the particular composition desired.

2—The castings are molded and poured on end. 3—They are gated through a ring of small pop gates rectangular in cross section fed from a circular pouring basin. 4—Cores are made both in loam and dry sand, in one piece and in sections, depending on local conditions including the length and diameter of the casting. 5—In some instances a ring pattern is employed. It is drawn up to the required length and forms both core and mold. In other instances a solid cylindrical pattern is drawn up in the same manner and the core is made in a corebox. In each instance the core is anchored to the bottom plate. Loam cores for large shells that are cast open at both ends are built on a foundation plate in the usual manner with a spindle and sweep.

In some plants the shells and ends for all dryer shells are cast separately and afterward bolted together through internal flanges. In other places the shells are cast with the ends in place. Naturally the method of making and anchoring the cores will depend on which method is employed.

6—Average thickness of metal in the cast iron flasks is 1 inch. 7—Thickness of sand between the pattern and flask will vary depending on the size of the dryer shell ordered and the available flasks. The minimum is about 2 inches.

Book Review

Chemical Formulary, Vol. III, edited by H. Bennett, 566 pages, published by D. Van Nostrand Co. Inc., New York, and supplied by The Foundry, Cleveland, for $6 plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

This book presents a collection of valuable, timely and practical formulas for making thousands of products in all fields of industry. Volume III is not a duplication or revision of the previous two volumes, but contains new and additional formulas. As far as possible, the editors have included information especially requested by users of the previous two volumes.

A special section is devoted to common names of chemical products, trade name chemicals, and an extensive index.

Leeds & Northrup Co., Philadelphia, has opened a New England office in the Chamber of Commerce building, Boston.

ADVERTISING PAGES REMOVED

Planning Cuts Costs

(*Concluded from page 29*)

ciple of the entire routine.

These units are termed units for assembly or costing and differ from ordinary subassemblies, which usually are established in the drawing room and may or may not be consistent with shop practice and costing methods, created according to shop and costing procedure.

From this it follows that a *UFA* is a minor portion of equipment that contains a number of component parts grouped into the individual *UFAs*, to permit assembly of the major equipment in the most efficient manner. These units are established according to the procedure to be described. They fall within the following groups:

1. A complete piece of apparatus which may be marketed or stocked as such and yet may be one of several units which will enter into the assembly or construction of a larger piece of apparatus or equipment. For example: a motor, valve, pump, heater, etc.
2. A complete group of parts, created or established by shop assembly, practice or methods. These assembled groups will exist as dependent units which will enter into the assembly or construction of a piece of apparatus or equipment. For example: A section of piping, steam chest, rotor, governor shaft, gear shaft, housing, etc.
3. An item required for cost accumulation purposes and covering work incurred in the execution of a contract. For example: Testing, special inspection, general drawing-room work, etc.

In special equipment industries, where the major portion of the productive capacity is dependent upon single item contracts, it is especially essential that all estimates be complete and accurate and take into consideration, in addition to the application of profit, all the following items of costs. These items, of course, will change with the plant set-up but are typical and will illustrate, in general, the routine and policies being presented: 1. Drawings and engineering; 2. Patterns, jigs and tools; 3. Testing; 4. Home or purchased material; 5. Labor of all classes; 6. Material handling charges; 7. Shop overheads; 8. Administrative overheads; 9. Selling overhead; 10. Inter-plant or department apparatus; 11. Erection costs or reserves charges. 12. Transportation charges. The special equipment industry is called upon to furnish quotations for all manner of contracts and special orders. Prior to presenting the estimating procedure for compiling or estimating these prices, it is imperative that a thorough understanding be had of the general types of these contracts or special orders. These types, in general groups, follow:

1. Those covering the furnishing of equipment which is entirely new and not produced heretofore.
2. Those covering the furnishing of equipment which has been produced heretofore.
3. Those covering the furnishing of equipment, part of which has and part of which has not been produced heretofore.
4. Those covering the furnishing of equipment which has not been produced heretofore but is similar to equipment previously produced.

Clearly Designated

Furthermore, it seems imperative that the general methods to be followed, in the preparation of estimates for the various types of contracts and orders, should be clearly designated, for both type and procedure. These types, with their salient points of procedure are, in general, as follows:

1. Where the equipment is identical to that previously made, the past costs may be used.
2. Where the equipment is identical to that previously made, but at such an early date as to render the costs useless, because of changes in labor rates and material values, the labor and material units (hour-pound etc.,) should be converted into their current money values and these calculated values used.
3. Where the equipment has never been produced, *SCEs* must be compiled, for the various parts, *UFAs* etc., and used in the development of the final *SDE*.
4. Where the equipment is similar to that previously produced, proportionate calculations in all probability will suffice. Where such calculations seem to be inaccurate and out of proportion, the procedure outlined for new equipment, (see section 3) should be followed.

These methods, of course, preclude the use of the basic principle, previously set forth, or the establishment and adherence to *UFAs*. They also incorporate an understanding that the values of such items as erection, transportation, engineering, tools and other development costs, together with interplant or interdepartmental apparatus, will be considered separately, and according to conditions and be included in the completd *SDEs*.

A typical *SDE* which could have been compiled by any of the stated methods, is shown in Fig. 1. This estimate covers the development of quotation, or final selling price for a piece of power plant equipment.

The corresponding *CA* for this piece of equipment, is shown in Fig. 2, and covers the accumulation of all labor, material, engineering, development, expense and special items incurred or expended during production of the equipment. In general, this accumulation has been compiled in a manner identical with the estimate and thereby permits a rapid comparison of the various items. Furthermore, this accumulation presents many special items of interest:

1. Gain or loss on the contract shown by a comparison between the gross cost and the billing price.
2. Difference between the gross cost and the gross estimate (billing price less profit).
3. Difference between the estimated and actual costs of development (patterns, tools, etc.).
4. Extra work encountered during the production of the equipment and chargeable as penalties to various departments but not to the contract.
5. Segregated costs of all classes of labor, material, expense and development gathered in comparable spaces to those on the estimate, permit rapid comparison and accurate analysis.
6. Various items of statistical data: Date shipped, shop order, customer, equipment, etc.

Careful study of these illustrations, unquestionably will show the virtues of a set-up of this nature from the standpoint of established routine, effectiveness and managerial desires.

Most companies allocate different lines of product to different plants, or at least their sales department, so that they may be operated or conducted independently or as subsidiaries with individual organizations, overhead factors, etc. This policy fosters the establishment of individual departmental records with corresponding credit for results obtained and elimination of any penalization from inferior efforts of other departments. It also sets up the practice of having a buying sales department, purchase equipment from second or selling sales department, at a value, which includes all shop costs, shop and plant over-heads, selling expenses. profits, etc., that would be incurred and included in arriving at a price for a regular or outside customer.

Therefore it will be noted on *SDE* Fig. 18,

Savings in Malleable Foundry

	Jan. 1934 June 1934	Jan. 1935 June 1935	Saving
New sand consumption..	2500 tons at $4.00 ton	250 tons at $4.00 ton	$9000.00
Clay bond consumption..	.....	300 tons at $3.50 ton	$1050.00
Disposal cost used sand...	2500 tons at $0.40 ton	250 tons at $0.40 ton	$900.00
Labor (sand).....	6 men	2 to 3 men	3 or 4 men
Scrap loss.....	Reported decrease approximately 25 per cent		
Cleaning cost.....	Reported decrease approximately 25 per cent		

that prices for equipment of this nature are inserted in spaces below the point where profit for the major estimate is added. This eliminates the duplication of profit.

Methods for applying expense, or overheads, vary with plants and organizations and are beyond the scope of this discussion. The method used in this set-up, was what is known as departmental percentage on labor. For example, and as shown on *SDE*, the machine shop overhead factor is 140 per cent, the tank shop is 75 per cent, the administration is 80 per cent, the pattern shop is 50 per cent etc.

Two classes of material set up and noted on the *SDE* may be defined as follows:

1. Purchased, which includes only the purchased material that enters into the equipment to be produced, and upon which no labor will be expended.

2. Includes all parts or castings to be produced and any purchased material entering into the equipment and upon which labor will be expended.

Expenses Are Prorated

Expenses involved in unloading, storing and transferring material within the plant, must be prorated and included in the cost accumulations of all contracts or orders. It is impractical to accomplish this distribution except by the application of an indirect charge, based upon a per cent of value. This method, as may be argued, has many short comings but is as accurate, for plants of this type, as any method that has been evolved. In this illustration a flat 10 per cent is used as a handling charge and is applied to all classes of material during the compilation of estimates or the accumulation of costs.

Costs of necessary indirect labor and material, incurred in the production of a piece of equipment, must be paid for whether it is included in the cost as separate items, or distributed as expense. This picture is dependent upon local opinions and plant policy.

In this illustration, all development expense, labor and material, that accrued in the execution of the involved contract, has been included in the estimate. This practice is the result of a policy, customary in special equipment plants, to charge such expense off with the contract, even though it may cause the contract to show a loss. If similar equipment contracts, using this development, are secured, they can be obtained at identical selling prices and lower development costs and the increased profit will offset the former loss. This radical policy has provoked considerable argument but still remains the best that has been advanced for plants of this type.

If the development costs of engineering, patterns, tools and jigs had been prorated and charged on a basis of so many contracts for equipment, say, ten, the amount of development allotted to this contract, would be 10 per cent with the remaining 90 per cent reverting to a development account for application to future contracts. This procedure would be ideal, even though it would involve a complex accounting routine, if it were not for the improbability of, or perhaps entire failure to secure similar contracts. Therefore the routine would preclude the creation of a large development equipment account which would be carried for a period and eventually charged off against profit and loss which essentially produces the same results as the policy of taking the loss at once.

In special equipment plants, all labor, except truckers, clerks etc., is expected to produce salable output and therefore is entitled to bear overhead. For this reason development labor, as shown in the illustration, is burdened. The same principle applies to development material or that entering into patterns, jigs, etc. It requires handling and has been burdened with the customary handling charge just as though the material were entering into a salable piece of equipment.

What has been written on this subject is associated definitely with special equipment plants and is not to be understood as applicable to or recommended for standard equipment plants where the spread of development is a mere matter of mathematics and allocation of a definite amount to each piece of salable equipment.

Allocating Overhead Expense

Arguments concerning the best methods for allocating or distributing overhead or expense are obtained readily but since discussion of this phase of accounting is beyond the scope of this article, it is sufficient to point out that provision has been made, on the *SDE*, and *CA*, for distribution according to departmental factors.

The set-up precludes the application of various prorated overheads for these segregated departments and shows the current factors which have been used. The application is identical and also comparable for both the *SDE*, and *CA*, which is of tremendous advantage for analytical purposes.

Methods shown in the illustration, for the inclusion of shop, administrative, selling and other items of overhead, may be modified readily to suit desired policies and still maintain the advantages of the described routine.

Numerous items, drawing numbers, covering the *UFAs*, costs of certain purchased items, general remarks and erection reserves may or may not enter into the estimated or actual costs, but they have their descriptive and analytical value and may be included or eliminated as desired.

Where costs of *UFAs*, are not available because of never having been produced, it becomes necessary to prepare separate and detail *SCEs*, to ascertain estimated shop cost. These *SCEs*, are made in terms of labor and material only with the overheads added by way of the *SDE*. Such estimates should originate in the engineering department, at the request of the sales development involved and should take into consideration the following items. A form for compiling this data readily can be developed.

Estimating Shop Costs

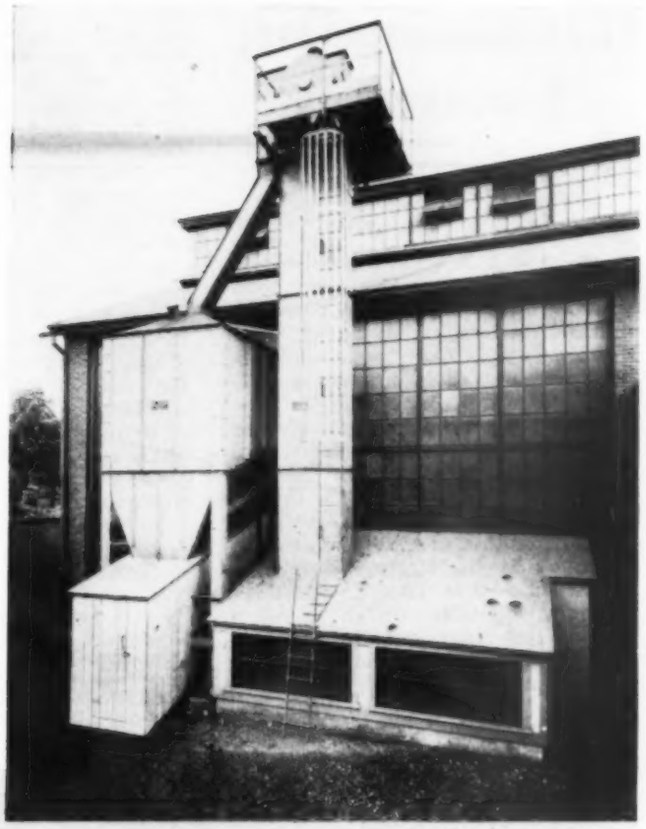
1. List of component parts or items
2. Material for the different parts or items
3. Number of parts or items required
4. Weight of the parts or items
5. Drawing numbers, part of pattern numbers of parts and items (where possible)
6. Where detail drawings do not exist, list those approaching in similarity
7. Sufficient sketches, drawings and information to make an accurate *SCE* possible.
8. Time required for engineering and drafting work

Upon the receipt of this sheet from the sales department, the estimators in collaboration with the shop foreman, method, rate and time study men, from the data given, and comparisons with similar work, will establish such time as is required for the manufacture of all listed parts or items. These units of time for the various operations are then converted into money, segregated for shops etc., and accumulated to produce costs for the complete UFA, which, of course, contains a segregated cost of development, patterns, jigs, tools etc.

Where it is known definitely that a *UFA*, or any part of it requires special development which can be used a number of times, a memorandum to this effect should be made on the *SCE* so that the accounting, cost, and other departments can arrange to apply the proper portion of the cost to the equipment being built and to arrange for charging the balance as may be directed.

This is the first part of an article describing a planning system which permits analysis and determination of errors and poor planning methods of production and other functional activities in a plant devoted to the production of special equipment. The concluding installment will appear in an early issue.
—The Editors.

HOW TO HANDLE IT IF IT IS SAND AND MOLDS



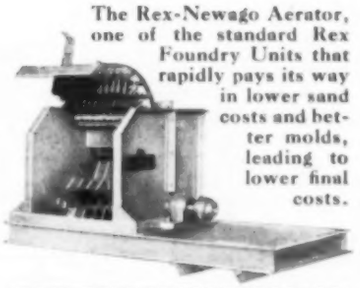
IT'S WORTH $428.00 TO SAVE $1.00 PER DAY

● The average molder spends 40% of his time shoveling sand and handling molds. The average foundry employs 20 molders at an average wage of $6.00.

On that basis the average foundry could spend $428.00 to save $1.00 per day on its molding costs. That average foundry could spend $14,677.00 on foundry sand and mold-handling equipment and pay for the investment in two years.

The Chain Belt Company has installed systems that cost less than that and met all the foundry's needs. It has installed more extensive systems that made greater savings.

This matter is something worth while talking over. Send the coupon for complete information.



The Rex-Newago Aerator, one of the standard Rex Foundry Units that rapidly pays its way in lower sand costs and better molds, leading to lower final costs.

CHAIN BELT COMPANY
1671 W. Bruce St., Milwaukee, Wis.

Please send us information on Rex Foundry Systems.

Name .....

Firm Name .....

Address .....

City ..... *State* .....

Type of Foundry .....

Daily Average Production ..... Tons

REX

CHAIN BELT COMPANY
of MILWAUKEE

Chain and Belt Conveying

Reclaiming Foundry Sand

(*Concluded from page 27*)

cleaning cost and low losses due to sand defects. New sand or bond costs are very low and in many instances the amount of burned core sand going into the system at the shakeout makes it unnecessary to add new sand to the system. The burned core sand is rebonded in the muller. Additions of bond, sea coal and moisture are made in the mixers. When all the sand is mulled each time it is used, a mixing cycle of 2 minutes, including loading, mixing and discharging, usually is sufficient. One large automotive foundry operating such a sand preparation unit requires only 2 quarts of bentonite for each 2500 pounds of sand.

Fig. 2 shows a small, simple, compact relatively inexpensive unit that provides means to clean and screen the sand, load it into the muller for proper conditioning and aerate it automatically as it discharges from the mixer into boxes for distribution.

Prepare Uniform Sand

With such a unit it is possible to control permeability by fines control, use a minimum amount of new sand or bond and moisture for workability, and to prepare a uniform sand in as nearly an ideal moldable condition as is possible.

The unit consists of a screening and magnetic separator for the removal of metallic and other refuse. The cleaned sand is fed into a skip hoist bucket loader. New sand also may be added in the bucket loader. The batch is elevated and charged into the muller where moisture, sea coal, etc., are added and mixed, usually in from 3 to 5 minutes. The prepared sand is aerated automatically as it leaves the muller. The entire unit is housed and exhausted with damper control on the exhaust outlets to control the amount of fines left in the sand.

This equipment in steel, gray iron, malleable and nonferrous foundries offers means of controlling the sand, reclaiming a considerable amount of sand formerly disposed of as refuse. Savings include: New sand consumption, cost of disposal of refuse sand, bond consumption, cleaning costs, scrap losses due to sand defects, improved surface and quality of castings, reduced labor cost (not always, but other savings more than offset any slight increase in labor).

A gray iron foundry pouring 25 tons of miscellaneous castings per day reports that new molding sand consumption was reduced 75 tons per month. Additional savings in cleaning costs, scrap losses and labor resulted in an overall saving of approximately $400 per month.

A successful sand control, conditioning and reclamation program may be had by the intelligent use of equipment to clean and screen the sand properly, control the amount of fines, properly prepare the sand in the muller and aerate the sand after conditioning.

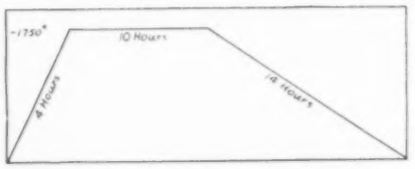
Equipment alone does not make the saving. Proper use of the equipment as applied to any particular problem, justifies the capital expenditure for modern sand conditioning, reclamation and control equipment.

Anneals Malleable In 24 Hours

(*Concluded from page 32*)

transferring heat from the heating elements into the charge in the furnace, low surface temperature and the special rod type elements.

Castings to be annealed are packed



Graph Showing Short Anneal Cycle

in rectangular pots and brought to the furnace on buggies running on a narrow gage railroad. The top of the buggy is the same height as the door sill of the furnace, a feature which greatly facilitates introduction and removal of the pots to and from the furnace. A turntable in front of each furnace and a short connecting section of track permit any necessary switching of loads. These various features are shown in Fig. 4.

This is the second and concluding article dealing with interesting features in the plant of the Olympic Foundry Co., Seattle. The first appeared in the September issue of THE FOUNDRY.

"Electro-organic Chemical Preparations," is the title of a recently issued publication of the engineering experiment station, University of Illinois, Urbana, Ill. The publication, which was prepared by Sherlock Swann Jr., tabulates a long list of electro-organic chemical preparations which give yields equal or superior to those obtained by purely chemical methods. Copies of the publication may be obtained from the engineering experiment station for 35 cents.

Announce Contests For Apprentices

The molding and pattern making contests, an outstanding feature of the Detroit convention and exhibition of the American Foundrymen's association, will be repeated at the 1937 convention and exhibition in Milwaukee. The contest will be sponsored by the association committee on foundry apprentice training, with competition provided in steel molding, iron molding and pattern making classes. If sufficient interest is evinced in the nonferrous field, competition will be organized in that group as well as in the ferrous fields.

First, second and third prizes of $40, $25 and $15 will be awarded in each class from entries sent to the 1937 convention.

Regulations of the committee provide that local contests may be held under the supervision of individual foundries or foundry groups. Copies of the regulations may be secured from the association headquarters at 222 West Adams street, Chicago.

The apprentice training committee, composed of men who have had wide experience in the training of foundrymen, is as follows: V. J. Hydar, chairman, personnel director, Falk Corp., Milwaukee; S. M. Brah, industrial coordinator, International Correspondence schools, Chicago; K. P. Crowell, supervisor of apprentice training, Caterpillar Tractor Co., Peoria, Ill.; C. J. Freund, dean, college of engineering, University of Detroit, Detroit; W. E. George, industrial engineer, American Steel Foundries, Chicago; J. G. Goldie, foundry instructor, Cleveland Trade school, Cleveland; J. E. Goss, apprentice supervisor, Brown & Sharpe Mfg. Co., Providence, R. I.; John Grennan, instructor of foundry practice, University of Michigan, Ann Arbor, Mich.; F. R. Hoadley, vice president, Farrel-Birmingham Co. Inc., Ansonia, Conn.; J. Morgan Johnson, vocational supervisor, Tri-City Manufacturers association, Moline, Ill.; and John H. Ploehn, superintendent, French & Hecht Inc., Davenport, Iowa.

Investigates Clay

Engineering experiment station of the University of Illinois, Urbana, Ill., recently has published a 42-page bulletin giving data on an investigation of clay bodies. The bulletin, which is No. 284, is entitled "Oxidation and Loss of Weight of Clay Bodies During Firing," by William R. Morgan. Copies of the bulletin may be obtained upon application to the engineering experiment station.

Finds Small Order Price

(*Concluded from page* 35)

ule of costs, it was found that variation existed in getting a 3 cent base job started as compared to a 30 cent base job. An *increasing* factor was determined that took into consideration the expense item previously mentioned and the molder's premium for short runs. A list was made which shows on the "small lot cost" an increase of about 35 per cent over the "base cost" on a 3 cent casting and approximately a 125 per cent increase on a 30 cent casting, gradually increasing from the low cost casting to the high. The rate of increase was determined more or less theoretically but after thorough checking it was found to average out satisfactorily.

It is necessary to set up the quantities for each new job but the mental computation is readily accomplished with the aid of the permanent table set up by the company. An example of the scale on which this table works is as follows: Base price per hundred weight for two days or more production is $4.50; for a job taking one to two days (8 to 16 hours) the base price is $4.70; one-quarter to one day (2 to 8 hours) $5.05; and for a job taking less than one-quarter of a day (less than 2 hours) the base price is $7.60.

A classification of molders has been made by the company, dependent upon their ability, experience, intelligence, etc. These men are graded A, B, C, and D class molders. The A molder is a specially skilled, premium-rate molder whose skill is more than that of a journeyman. The B molder is an all-around journeyman who is able to handle any job in his particular line. The C molder is one whose skill is about the average of a two to three year apprentice. His rate is about 84 per cent of that earned by a B molder. The D molder is one ordinarily having from three months to two years experience, rated 70 per cent of the B molder's rate. The company emphasizes that if a D molder shows promise it does not hesitate to give him a C job, or a C molder a B class job, where he can increase his earnings if his workmanship justifies it.

Jobs Rated as Received

This implies that all jobs are classified as they are received and at the time a piece-work price and production are set. The company makes it a practice to send class information into the foundry along with the piece-work price and the notation of the premium that the size of the order will earn, so that each molder knows at all times exactly what he is to be paid. Although no premiums are paid for coremaking, there is a classification of coremakers also. These men are graded A, B, C and D as are the molders, although in this case the A coremaker is a journeyman.

The schedule of costs is split into four divisions based upon the time required to produce orders. This was formed by use of a classified table involving such items as the average time to produce an order, pounds produced in average time, short order charge per order, short order charge per hundred weight per average time and cost price per hundred weight including short order charge. This applies to squeezer and bench jobs. On molder and helper jobs, six days production is considered base instead of two. On jobs utilizing a mechanical pouring rig, three days instead of two, on two and four men jobs, six days and on crane jobs a ten day figure is given as base, although this is subject to variation.

It would appear impossible to use such cost figures, set up into table form with the time required to produce an order as a basis, because of the wide variation in costs, but it is explained by the company that customers have seen the fundamental soundness of variations in selling prices due to the "set-up" charges necessitated by short order runs. It has called their attention to economies they have been able to effect in their own costs, because castings usually ordered at prices higher than base can have the quantities increased to earn a lower casting price, and they have also in many cases run through larger lots in their own plant to reduce the part costs. Customers have made gains in their casting costs and the company referred to has had profitable short orders.

Nonferrous Meeting In Connecticut

Members of the Connecticut Nonferrous Foundrymen's association met Sept. 15 at the New Haven yacht club, New Haven, Conn., for dinner and the opening meeting of the fall and winter season. David Tamor, metallurgist, Reading-Pratt & Cady Co. Inc., Hartford, Conn., led a discussion concerning the American Foundrymen's association convention which was held last May. Technical papers presented at that convention were discussed. The next meeting will be held Oct. 20, at which M. L. McGuire, George F. Pettinos Inc., Philadelphia, will talk on "Sand Bonds."

Book Review

The American System Shall We Destroy it?, by S. Wells Utley, cloth, 295 pages, published by Speaker-Hines Press, Detroit, and supplied by THE FOUNDRY, Cleveland, for $3.00 plus 15 cents postage.

S. Wells Utley, president of The Detroit Steel Casting Co., Detroit is well known throughout industry for his keen analysis of economic questions and the presentation of the industrial viewpoints on public matters. For the past 10 years Mr. Utley, who heads a steel foundry making railway and miscellaneous castings, has given a large measure of his time and effort to unrecompensed public service. He is a champion of the freedom of the individual, the benefits of the American system of government and industry, and a combative opponent of the encroachment of governmental restrictions upon private business.

In this book Mr. Utley presents a clear, interesting and authoritative analysis of the American system. He contrasts it with those examples of the failure of centralized, regimented and politically directed systems of the past and at present being followed in other countries.

While much that he offers is available in hundreds of volumes of history, law and economics, Mr. Utley's work has brought together and sifted in the light of human well being, the facts and figures to support his comprehensive brief for the American system.

This book should be read and studied by every thinking American. It offers to the busy industrial leader the most readily available summation of facts. It presents to the politician who is honest in his attempt to fathom the complexities of modern industry a most valuable guide upon which to build his economic policies. It should form a reference work for every advanced college class in history and economics. It gives to industrial leaders a new appreciation of their own worth and service in the modern world.

Survey Indicates Employment

(*Concluded from page* 33)

lighting equipment, enamel ware, watches, jewelry, cameras, etc., show 90.9 per cent and machinery shows 85.5 per cent.

The highest employment is shown in wearing apparel with 115.1 per cent; in chemicals with 109.5 per cent and in wholesale and retail trade with 106.8 per cent.

Obituary

EDWIN E. Linthicum, 70, president of the National Cast Iron Pipe Co., Birmingham, Ala., died Sept. 29 in Birmingham. A native of Maryland, he moved to Georgia as a child and was educated in that state. He first worked in the foundry industry for a pipe firm in Anniston, Ga., after starting his business career as a telegraph operator. Mr. Linthicum was a pioneer in the cast iron pipe business in Birmingham having helped organize the American Cast Iron Pipe Co. in 1905. He formed the National Cast Iron Pipe Co. in 1912. During the war he was a member of the manufacturer's war committee. Mr. Linthicum was prominent in civic, business and religious activities.

♦ ♦ ♦

Ferdinand Grote, 89, founder of the F. Grote Mfg. Co., Evansville, Ind., died in Evansville recently.

♦ ♦ ♦

Charles Spoeneman, 75, president of the Enterprise Foundry Co., Belleville, Ill., died Sept. 24 in that city. He was a pioneer foundryman in the Belleville area.

♦ ♦ ♦

Emil A. Peterson, 71, president of the Valley Iron Works, Appleton, Wis., died in Appleton Sept. 13. He became superintendent of the plant in 1898, treasurer and general manager in 1905 and president in 1921.

♦ ♦ ♦

Norman L. Daney, 52, treasurer and general manager, Harris-Seybold-Potter Co., Cleveland, printing machinery manufacturer, died in Cleveland Sept. 13.

♦ ♦ ♦

Charles T. Seybold, 78, founder of the Seybold Machine Co., which in 1927 was merged with the Harris-Seybold-Potter Co., Cleveland, died in Dayton, O., Sept. 27.

♦ ♦ ♦

G. Lewis Walters, 62, vice president, secretary and treasurer, Adams & Westlake Co., Chicago, died Oct. 1 in Chicago. He was born in Chicago and attended high school there, later taking a course at the Lewis institute. Mr. Walters entered the service of the company as a factory errand boy in 1890, advancing steadily during the succeeding 46 years of his business career. He was assistant to the vice president in charge of sales from 1902 to 1910, sales manager from 1910 to 1925 and secretary-treasurer from 1925 to 1936, at which time he was elected to the position which he held at the time of his death. Mr. Walters was active in Chicago civic work and was a member of the Illinois Manufacturers' association.

♦ ♦ ♦

John H. Francis, 74, president of the Kilby Mfg. Co., Cleveland, died recently at his home in Shaker Heights, O. Born in Wales, Mr. Francis began his career with the Kilby company 50 years ago, becoming foreman, superintendent, manager, general manager and later president of the concern. He was on the advisory board of the Gray Iron Founders society and a member of the Cleveland chamber of commerce.

John H. Francis

♦ ♦ ♦

Alex K. Hamilton, president of the M. H. Treadwell Co., Chicago, died in Chicago Sept. 8. Before becoming president of the Treadwell company in 1908, he was chief engineer for the Lackawanna Steel Co., Buffalo, and later chief engineer and general superintendent of Milliken Bros. Inc., Staten Island, N. Y.

♦ ♦ ♦

Dr. Samuel Montgomery Kintner, 65, vice president in charge of engineering, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., died Sept. 28. Internationally known in the engineering world for research in the development of radio communication and broadcasting, Dr. Kintner received his early education in the public schools of New Albany, Ind., and his technical education at Purdue university from which he graduated in 1894 as an electrical engineer. For 3 years he was professor of engineering at the Western University of Pennsylvania, resigning in 1903 to accept a position in the research department of the Westinghouse company. Four years later Dr. Kintner was made design engineer. He resigned in 1911 to become general manager of the National Electrical Signalling Co., later becoming president. Following the war he negotiated a sale to the Westinghouse company of the patent rights of his company which later were sold to the Radio Corp. of America. In 1930 he was elected assistant vice president in charge of engineering activities and vice president in 1931, of the Westinghouse Electric & Mfg. Co. He received two honorary degrees during his life.

♦ ♦ ♦

Joseph B. McGlynn, 72, employe of the West Steel Casting Co., Cleveland, for 47 years and foundry superintendent for the past 25 years, died Sept. 14 in Cleveland. Going to Cleveland in 1884, he was employed by the West company 5 years later as a molder. In 1914 he was appointed superintendent.

♦ ♦ ♦

John Campbell, 63, founder and president of the Campbell Foundry Co., Harrison, N. J., died Aug. 10 at his home in South Orange, N. J. Born in Glasgow, Scotland, he came to the United States at the age of 15 and in 1892 entered the employ of the Maher & Flockhart Co., Newark, N. J., which later became the Flockhart Foundry Co. Mr. Campbell was secretary of that company when he resigned in 1921 to establish his own company.

Book Review

Metal Statistics—1936, cloth, 572 pages, published by the *American Metal Market*, New York, and supplied by THE FOUNDRY, Cleveland, for $2.00 and in Europe by the Penton Publishing Co. Ltd., London.

This is the twenty-ninth annual edition of the statistical presentation, and contains a wide assortment of information on ferrous and nonferrous metals, and miscellaneous economic subjects. The iron and steel section has been enlarged by the addition of monthly average prices on fixed classifications of scrap. Another new table records weekly steel production schedules, since first announced by the American Iron and Steel institute.

Pittsburgh Meeting

Pittsburgh Foundrymen's association will meet at the Fort Pitt hotel, Oct. 19. F. J. McGrail, superintendent of foundry, Struthers Wells Titusville Corp., Titusville, Pa., will speak on "Foundry Apprentice Courses and Foreman Training." W. G. Connor, Jr., Wallworth Co., Greensburg, Pa., will lead the discussion.

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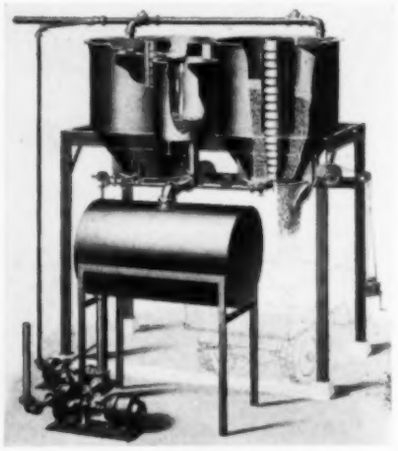
Ohio Ferro-Alloys Corporation
Canton, Ohio

NEW EQUIPMENT . . . . *for foundries*

Unit Dewaters Sludge Accumulations

Claude B. Schneible Co., 3951 Lawrence avenue, Chicago, has developed a dewatering tank for use with wet dust collector units. The new unit, which is shown in the accompanying



Water containing solids enters the dewatering tanks at the top

illustration, is designed for dewatering accumulated sludge in the settling cone of multiwash dust collectors.

In operation, the water containing solids enters the dewatering tank at the top through a baffled section which prevents undue disturbance of the water in the tank. A constant level is maintained in the tank at all times, the excess water flowing over a weir on the opposite side of the tank from the inlet. The overflow water enters a surge tank from where it is recirculated in the dust collector system.

It is claimed the low velocity of water in the tank allows complete precipitation of solids in the area around the cone in the center of the tank. When the tank is filled sufficiently with precipitated material, the inflow water is switched to another tank in the dewatering unit. After a short precipitation period, a valve on the line leading to the interior of the cone is opened, and the head of water in the draining tank is allowed to recede slowly. The water flows out of the precipitated material and does not carry the material with it due to the angle of repose of the material against the cone in the center of the tank. The final draining period will reduce the moisture content in the sludge to about 20 per cent, depending upon the absorbent qualities of the material. When the sludge in the dewatering tank is drained completely, the bottom gates are dropped to allow the material to fall into a truck, railroad car, or other convenient receptacle. Various sizes of dewatering units are available.

Chain Hoist Is Made In Several Sizes

Conco Engineering Works, Mendota, Ill., has introduced a spur-geared, hand-chain hoist in which ball bearings are used in both the inner and outer races as well as the bearing rollers. This type is used for material handling in most industries, in capacities from ¼ to 6 tons, although other similarly designed hoists are available up to 20 tons capacity.

To lift its rated load one foot, the 1½-ton hoist requires a chain overhaul of 35 feet and chain pull of 100 pounds; the 3-ton hoist, a 70-foot chain overhaul and 101-pound chain pull; and the 6-ton hoist, 133.5-foot chain overhaul and 117-pound chain pull. A safety load chain guide is provided.

Diesel Engine Built For Heavy Duty

Changes in design have been made in a diesel engine recently developed by the Ingersoll-Rand Co., New York. It is of the vertical, four-cycle, single-acting, solid-injection type for running at medium speeds. The unit has been built for heavy-duty, continuous service, and its fundamental construction is similar to that of the company's locomotive engine. Made with 3, 4, 5, 6, and 8 cylinders, the engines are available in wide variety of sizes from 150 to 460 horsepower.

Instrument Tests Core Hardness

Harry W. Dietert Co., Detroit, recently has introduced the instrument shown in the accompanying illustration, used for measuring accurately the surface hardness of cores and dried molds. It weighs 9 ounces, is 3 inches high and ¾-

Principle of the tester is similar to the finger nail scratch test

inches wide. Principle of the tester is similar to the finger nail scratch test employed by foundrymen, but the advantage of the instrument is said to lie in the accurate determination of a figure which may be used for comparative purposes through a series of tests.

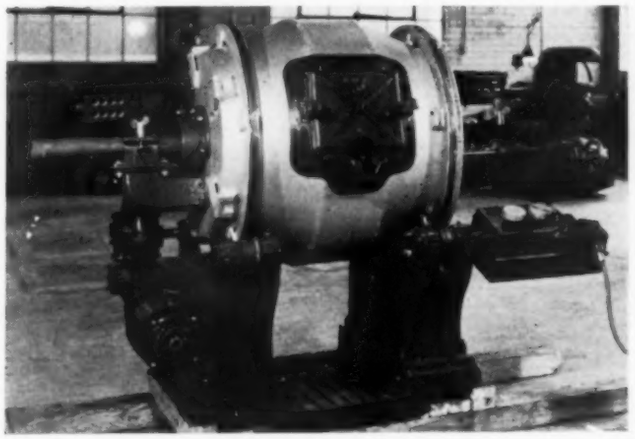
The unit consists of a special dial indicator mechanism which measures the depth penetration of a diamond cone point into the surface of a core. The diamond point is mounted on an independent lever. The force required to pull the point along the core surface is not exerted on the measuring mechanism. It is claimed that the tester may be kept in calibration easily.

D. H. Skeen & Co., Chicago, has been appointed sales representative for the George P. Reintjes Co., Chicago. The company will specialize in the sale of supported walls and arches, as manufactured by the Rentjes company, in the Chicago area.

ADVERTISING PAGES REMOVED

Electric Furnace Has New Shell

A new 350-pound furnace for high temperature melting has been developed by the Detroit Electric Furnace Co., Detroit. This furnace, shown in the accompanying illustration, has been designed especially for melting copper, nickel and alloy irons and steels. The arc at the center of the furnace is farther away from the refractory than at the ends of the shell, which is of larger diameter around the central portion than at the ends.



A remote pouring switch and magnetic brake motor have been included

A changed hearth design is claimed to permit easier tapping and cleaning. The new furnace is equipped with automatic rocking control, a remote pouring switch and a magnetic brake motor has been included as standard equipment of the rocking mechanism. The shell and refractory design are such that the metal constantly is brought back to the hottest part of the furnace immediately adjacent to the arc.

Develops Oil Fired Core Oven

Improved operations, from the standpoint of costs, quality of product and capacity, are claimed for a new core oven introduced recently by the Despatch Oven Co., Minneapolis. The unit, which is oil-fired, is of metal panel construction, employing 16 gage steel sheets on the outside. Insulation consists of 4 inches of rockwool.

The oven illustrated was installed in a jobbing foundry to replace two coke-fired core ovens which were of brick construction and had a larger interior capacity. The new oven is 5½ feet wide, 6 feet high and 8 feet deep inside. Capacity is 2000 pounds per charge, with the baking time varying from ½ to 5 hours, depending on the size of the cores.

Uniform heating is said to be obtained by the arrangement of the heating system in the bottom of the oven and the use of heat distributing baffles. Ducts are placed so that the air circulation is positive. Close adjustment of the temperature results from use of an automatic control. Oil consumption varies from ½ gallon to 2½ gallons per hour, with the average hourly operating cost reported as 10 to 12 cents.

Baking time varies according to size of cores

Louvre Dryer Has Rotating Drum

Link-Belt Co., Chicago, has acquired the manufacturing and sales rights for North America for the Dunford & Elliott rotary louvre dryer. Used for the drying of all types of granular materials, crystals and powders, refuse, vegetable products, etc., the dryer may be described briefly as a mechanically rotated horizontal drum with a series of internal channels near the circumference, into which hot air is admitted from a fan.

These channels are covered by tangential plates which overlap in such a way as to leave a gap for hot air to pass from the channels into the inside of the drum and the material, and at the same time prevent any material from falling backward. As the drum revolves, fresh channels come underneath the charge but since the hot air can only enter channels which actually are under the charge, all the gases must pass upward through the bed of material. Slow rotation of the drum is said to give a gentle mixing action, resulting in efficient heat transfer and uniform drying.

Heater Is Suspended From Steam Line

Modine Mfg. Co., Racine, Wis., has developed a unit heater designed for industrial plants where clogging is caused by the presence of foreign matter in the air. Condenser fins are spaced wider, the rear edges of these fins are designed with a decided downward curvature and the entire condenser has been processed to accelerate passage of lint and other matter through the unit.

Suspended directly from the steam line it takes little space and directs the heat downward to floors and working zones. This type heater is made in 12 sizes, all applicable to gravity, vacuum or vapor heating systems and is guaranteed for operation on 150 pounds steam pressure.

Electric Air Heater Is Introduced

American Foundry Equipment Co., Mishawaka, Ind., has added a new unit to its line of electric air heaters. Obtainable in any size necessary to fit heating requirements of the room, the element used is of cast aluminum construction, heating being done by a calrod around which the aluminum grid is poured.

Shrinking of the metal in cooling causes the calrod to become an integral part of the heating element, eliminating hot wires and dead air space. Each unit is controlled thermostatically and individually. The heater incorporates the modern, widely accepted factors, forced circulation and convection methods of heating in its design.

Lift-Trucks Employ Auxiliary Frame

An auxiliary frame for hand lift-trucks, introduced by the Barrett-Cravens Co., Chicago, is said to be a definite aid to companies handling skids that vary in underneath clearance. When mounted on a truck 6 inches high in the lowered position, this frame can handle skids with an underneath clearance of 6½, 7½, 9½ and 10½ inches.

A slight kick on the release bar lowers the auxiliary frame

When mounted on a truck 7 inches high the unit will handle skids with an underneath clearance up to 12 inches. The truck is run under the skid, the auxiliary handle is pulled forward and the frame is brought up snug under the skid. A ratchet holding device keeps it in place and the loaded skid is ready to be lifted. A slight kick on the release bar lowers the auxiliary frame. The truck is shown in the accompanying illustration.

Foot Guard Will Fit Over Any Shoe

Ellwood Safety Appliance Co., Ellwood City, Pa., recently has designed the foot guard, shown in the accompanying illustration. The guard fits any shoe and it is claimed it cannot be kicked off.

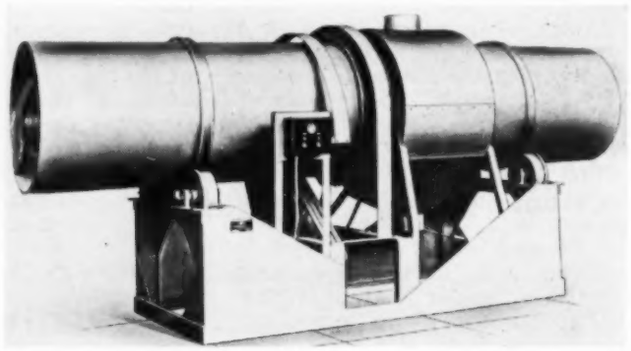
The guard is fitted with a silent tread

Three point contact gives balance, snugness and eliminates vibration. The guard is fitted with silent tread, an adjustable cowhide strap and a quick spring fastener. It is made in either aluminum alloy or galvanized steel, corrugated for resistance to impact, effective under a 300-foot-pound blow. A single aluminum alloy guard weighs 12 ounces, about the same as a low-cut rubber overshoe.

Cleans Both Castings And Gates

A means for giving castings, gates and sprues an initial cleaning is provided in the cleaning mill recently produced by N. Ransohoff Inc., Cincinnati. In the model shown, in the accompanying illustration, the drum is 36 inches in diameter and 10 feet long, receiving the gates at the charging end from a pan hung on a monorail while the mill is running.

Work received in the first section is fed, by a heavy spiral worm welded to the inside of the shell, into the second or tumbling section where gates and sprues are broken off, core sand shaken out and gates, sprues and castings given a cleaning which serves for the first two items and prepares the third item for final cleaning. Dust and sand are trapped in the exhaust hood surrounding the drum. Discharge end of the mill is equipped with a lock-washer head so that reversal of the drum rotation direction automatically discharges the work.



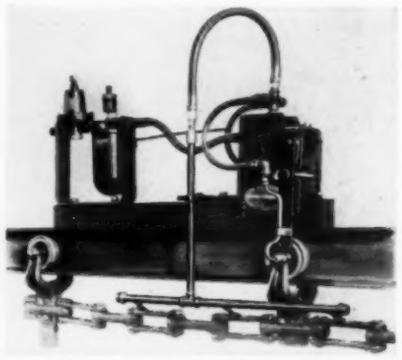
Work is carried from the first to second section by a spiral worm

Recording Pyrometer

C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., has developed a new 2 and 3-position recording controlling pyrometer. Fewer moving parts due to the absence of any reciprocating balancing or control arms or cams is a feature claimed for the instrument. Control is accomplished by movement of the recording carriage with its ink stylus above or below the control contact assembly. A large scale clearly indicates the actual temperature, recorded in red ink.

Lubricating Device Applies Oil Fog

A device, shown in the accompanying illustration, which applies lubrication in the form of an oil fog to every conveyor trolley as it passes a given point, and in the same manner lubricates every pin in the chain links has been developed by the J. N. Fauver Co. Detroit. The self-contained assembly is mounted on the conveyor rail at any convenient point and works automatically.



The unit is mounted on the conveyor rail at a convenient point

Air pressure from the plant air line is regulated by a valve and then passes through an air line lubricator where oil is fed drop by drop to the air stream to form a fine mist. The trolley wheel, passing under the lubricator, trips a trigger which automatically releases a jet of oil fog which is applied directly to the bearing. The lubricator has sight feed and regulation of volume of oil fed to the air line is controlled accurately.

Made Representative

C. D. Hollins, 2132 Morse avenue, Chicago, has been appointed special sales representative for the Campbell-Hausfeld Co., Harrison, O., in the states of Illinois, Iowa and Wisconsin.

Eliminate Costly Metal Irregularities

Pouring from Modern Cylindrical Ladles into hand ladles and molds.

with

Modern Covered and Insulated Mixing and Distributing Ladles!

Hard spots in castings causing the loss of thousands of dollars in scrap castings, and tool set-ups can be largely eliminated by using these ladles. For this purpose the elongated mixer ladles shown above offer the following advantages:

1. Larger quantities of metal can be held for longer periods, insuring a thoro mix.

2. They are covered and insulated so that the temperature loss in the ladle is negligible.

3. Refining with a flux such as Purite is equally practical for light castings and for foundries melting as low as one or two tons per hour.

4. Boiling is limited to one end of the ladle where the iron and flux enter. The metal quiets down, with complete separation of the slag as it travels across to the teapot spout.

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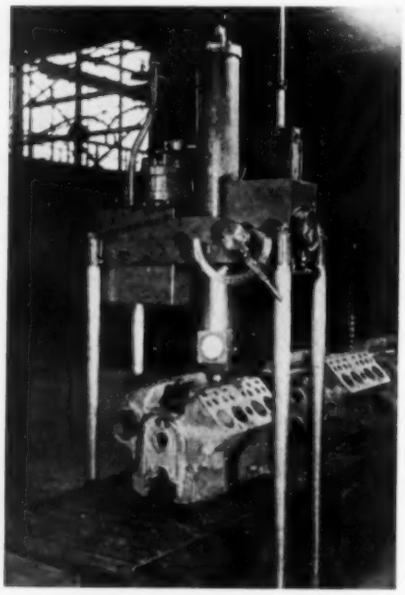
Improved Bottom-Pour Ladles
Metal Pouring Systems
Crane and Monorail Systems for Metal and Mold Handling
Furnace Charging Cranes
Sand Conditioning Systems

MODERN EQUIPMENT CO.

Direct Reading Unit Tests On Conveyor

Detroit Testing Machine Co., Detroit, has developed a brinell testing machine which makes a direct reading on a conveyor without elevating die blocks, cylinder heads and blocks, etc., to the testing position. The ram has a travel of 24



Oil is kept at constant temperatures by thermostatic control

inches and may be held at a height to accommodate the size of blocks on production. The conveyor section is spring mounted. The entire unit is shown in the accompanying illustration.

After tolerance hands are set to desired limits, the operator merely notes that the indicator pointer stops within them. Oil is used as a pressure medium and is kept at a constant temperature with a thermostatically controlled heating element. Work gap between posts is 24 x 31 inches.

Book Review

Alloys of Iron and Carbon (Volume I—Constitution), by Samuel Epstein, 476 pages, published for the Engineering Foundation by the McGraw-Hill Book Co., New York, and supplied by THE FOUNDRY, Cleveland, for $5.00 plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

This volume, the seventh of the Alloys of Iron Research Monographs series, is the first portion of a correlation and critical summary of the world's knowledge on iron-carbon alloys. The monograph was prepared at the Battelle Memorial institute, Columbus, O., as a part of the institute's contribution to alloys of iron research. Previous publications include *Alloys of Iron and Molybdenum, Alloys of Iron and Silicon, Alloys of Iron and Tungsten, Alloys of Iron and Copper, Principles of Phase Diagrams* and *The Metal-Iron.*

This seventh volume is on constitution and heat treatment and a later volume, now in preparation, is to be on the subject of properties. Containing less factual data and more theoretical discussion than the other monographs, the volume is a correlation of fundamental information on carbon steels and cast irons, and a base line for evaluating the effects of these other alloying elements. Explanations of the more important phenomena which take place when iron-carbon alloys are heated or cooled are valid for all, or at least nearly all, alloy steels.

Subjects of interest and value to the foundryman, engineer, melter, metallurgist, or superintendent discussed in this volume include the iron-graphite diagram, arrested transformations, principles, underlying hardening changes on tempering iron-carbon alloys and operations of quenching, tempering and hardening.

Castable Refractory Has Many Uses

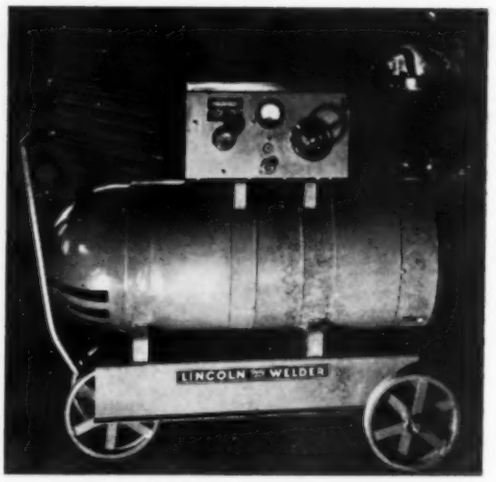
Quigley Co., New York, has produced a castable refractory, which is handled like concrete and can be cast into any desired shape or form. It may be used for casting special shapes needed in a hurry, monolithic furnace linings, boiler door arches and jambs and furnace door linings.

The recommended service temperature limit of this product is 2600 degrees Fahr. within which it is claimed to possess properties of strength, freedom from shrinkage, low permeability and resistance to spalling. Made in an industrial and domestic oil burner brand, the refractory can be subjected to heat within 24 hours depending on the size of the job, requires no cutting or ramming and is easily mixed with water and poured into forms.

International congress on technical education will be held at Rome, Dec. 28, 29 and 30, 1936.

Arc Welder Features Dual Adjustment

A line of single operator arc welders has been developed by the Lincoln Electric Co., Cleveland. The welder, shown in the accompanying illustration, has a new method of arc control, which it is claimed, makes possible the adjustment of both arc heat and arc penetration in a continuous sequence



The unit features a new method of arc control

of fine increments. The new welder retains all of the design points such as independent excitation, laminated magnetic circuit, all purpose meter, polarity reversing switch, etc. The base and portable parts have been redesigned for a more streamlined effect and shorter wheel base. The units are available in numerous types and ratings.

Centrifugal Pump

Worthington Pump & Machinery Corp., Harrison, N. J., has developed a small, centrifugal pump which is supplied with direct motor drives or with pulleys for belt drive and motor in sizes ranging from 1/3 to 3-horsepower and delivering from 10 to 130 gallons per minute with heads from 10 to 100 feet.

The shaft is supported by two ball bearings enclosed in a dirt and moisture proof housing. Suction head is easily removed for inspection of the interior. A choice of standard, all-iron and all-bronze fittings is offered.

Hammond Machinery Builders Inc., Kalamazoo, Mich., has established a new Eastern branch office at 148 West Twenty-third street, New York, in charge of W. J. Holtmeier, eastern manager.

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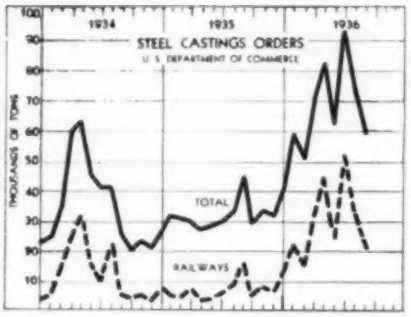
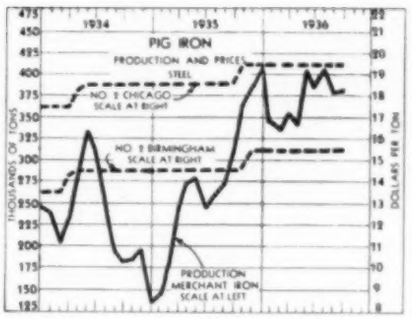
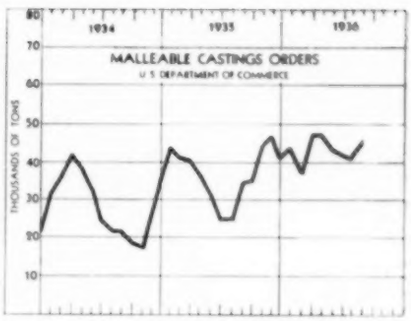






Foundry Activities

GREAT Lakes Foundries Co-Operative, Milwaukee, has been incorporated under the laws of Wisconsin with an authorized stock of capital of $65,000, to take over and operate the plant of the Great Lakes Malleable Co. which has been inactive for 3 years. A new building is being erected to house a cupola and blower and a new elevator has been installed. New processing machinery has been purchased also. John W. Sanders is president.

* * *

M. Knecht & Son, West Salisbury, Pa., foundry and machine shop was destroyed by fire recently.

* * *

Progressive Aluminum Co. recently moved its plant from Brooklyn, N. Y., to 1305 Forty-fourth avenue, Long Island City, N. Y.

* * *

Vulcan Foundry Co. recently has been established at Homer, Mich., by James A. Murphy and James T. Wadsworth.

* * *

Flynn Bros. have moved from Hoboken, N. J., to a new plant at the corner of Eighteenth street and Park avenue, Weehawken, N. J.

* * *

Simonds Saw & Steel Co., Lockport, N. Y., is taking bids for construction of a foundry costing over $37,000. A. Gould is manager.

* * *

Gardner Denver Co., Quincy, Ill., is building a new foundry building costing $250,000. Machinery is expected to cost $100,000.

* * *

Flower Valve & Foundry Co., Bessemer, Ala., will spend $1,250,000 for remodeling the plant of the Bessemer Foundry & Machine Co., recently purchased. Machinery will be installed for manufacturing valves, hydrants and other specialties in addition to the regular foundry work.

* * *

Leeds & Northrup Co., Philadelphia, has opened a New England office in the Chamber of Commerce building, Boston.

* * *

Elyria Foundry Co., Elyria, O., will let contracts soon for the construction of a 1-story, 80 x 400-foot foundry costing $100,000. W. F. Goldman is manager.

* * *

Western Malleables Inc., Beaver Dam, Wis., founded in 1892 as the Beaver Dam Malleable Iron Co., has closed its plant and will liquidate the business. The plant shut down Sept. 18.

* * *

Gould Coupler Corp., Rochester, N. Y., has succeeded to and acquired the entire business of the Gould Coupler Co., Rochester, as of Sept. 17. No change is contemplated in policies, management or business operations.

* * *

Banner Iron Works, St. Louis, is starting the construction of a 1-story foundry addition to its plant, for the manufacture of gray iron castings. Approximately $30,000 will be spent, including expenditure for new equipment. W. T. Koken is president.

* * *

Acme Brass Foundry Co. Inc., Lowell, Mass., has been formed to do a general foundry business. The new concern will take the place of the Acme Brass & Aluminum Foundry Co., previously operated at the same address, 62 Leverett street.

* * *

Cooper Alloy Foundry Co., Elizabeth, N. J., has established a new service devoted to specialized machine work on stainless and heat resisting alloys. It will be conducted under the title of Stainless Engineering & Machine Works. Harry A. Cooper is president of the company and M. J. Robert is vice president and general manager.

* * *

Index of foundry equipment orders, according to a report of the Foundry Equipment Manufacturer's association, Cleveland, was 144.8 in August, 1936, as compared with 159.6 in July and 11.3 in August of last year. Index of shipments was 137.2 in August, 1936, 145.7 in July and 153.0 in June of this year and 97.2 in August, 1935.

RAW MATERIAL PRICES
Oct. 7, 1936

Iron	
No. 2 foundry, Valley	$19.50
No. 2 Southern Birmingham	15.50
No. 2 foundry, Chicago	19.50
No. 2 foundry, Buffalo	19.50
Basic, Buffalo	18.50
Basic, Valley	19.00
Malleable, Chicago	19.50
Malleable, Buffalo	20.00
Charcoal iron, furnace	22.50
Coke	
Connellsville beehive premium	$5.50
Wise county beehive coke	$ 4.45 to 5.00
Detroit by-product coke	9.00
Scrap	
Heavy melting steel, Valley	$16.50 to $16.75
Heavy melting steel, Pitts.(dlv.)	18.00 to 18.50
Heavy melting steel, Chicago	16.00 to 16.50
Stove plate, Buffalo	10.00 to 10.25
Stove plate, Chicago	9.00 to 9.50
No. 1 cast, New York	12.50 to 13.00
No. 1 cast, mchy., Chicago	14.00 to 14.50
No. 1 cast, Pittsburgh	15.50 to 16.00
No. 1 cast, Philadelphia	16.50 to 17.00
No. 1 cast, Birmingham	11.50 to 12.50
Car wheels, iron, Pittsburgh	17.50 to 18.00
Car wheels, iron, Chicago	16.50 to 17.00
Railroad malleable, Chicago	18.50 to 19.00
Malleable, Buffalo	15.50 to 16.00
Nonferrous Metals	
	Cents per pound
Castings copper, refinery	9.40
Straits tin	45.00
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary, standard)	16.75 to 17.25
Lead, New York	4.60
Antimony, New York	12.50
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.85

Output of gray iron and steel castings in the Philadelphia federal reserve district declined about 4 per cent during August, according to reports received by the industrial research department of the University of Pennsylvania. Shipments of iron and steel castings also decreased, but the volume of unfilled orders at the close of the month was larger than at the beginning This increase was especially significant in the gray iron foundries in which shipments made during August were so well sustained that they indicate a depletion of any stock of finished castings on hand. Stocks of pig iron declined in August.

New Trade Publications

MOLDING MACHINES—Tabor Mfg. Co., Philadelphia, describes its line of standard molding machines and foundry equipment in a recently published booklet. Jar flask lift machines, squeezers and jar squeezers, plain and shockless jarring machines, rollover machines, etc., are described and descriptions of its line of cupolas, dust collectors, tumbling barrels, etc., are included.

FIELD LIGHTING—Crouse-Hinds Co., Syracuse, N. Y., shows installations for floodlighting fields in a recent publication.

WAREHOUSE DISTRIBUTION—International Nickel Co., New York, has prepared in booklet form a complete listing of warehouse distributors regularly carrying nickel alloy steels in stock throughout the country.

FLOOR TRUCKS—Lewis-Shepard Co., 175 Walnut street, Watertown, Mass., has published an illustrated circular on its line of easy-rolling floor trucks for factory and warehouse. Several new types of caster trucks, rubber-tired trucks and shelf trucks are shown.

FLUXES—Foundry Services Inc., 107 East Forty-first street, New York, has issued individual bulletins on a few of its line of fluxes. Its iron regenerator, its flux for aluminum castings in sand and dies and its aluminum de-gaser are given prominence in the description.

INDUSTRIAL CLEANING — Breuer Electric Mfg. Co., 846 Blackhawk street, Chicago, has prepared a bulletin on its portable industrial vacuum cleaner. Economical features, new design, weight and attachments are described and illustrated in detail.

LIGHTING—Holophane Co., 342 Madison avenue, New York, has published a new catalog on lighting facts which contains 44 pages of illustrations and descriptions on the company's line of new equipment for scientific lighting. Contents have been classified to facilitate reference.

PHOTOMICROGRAPHIC EQUIPMENT—Bausch & Lomb Optical Co., Rochester, N. Y., describes the following factors in photomicrography in a recent booklet: The microscope; the objectives, eyepieces and condensers; the illumination; and the mechanical aspects. Various types of cameras, equipment and miscellaneous accessories are presented also.

PUMPS—Worthington Pump & Machinery Corp., Harrison, N. J., recently has published data and pictures of its vertical two-stage compressors, air cooled, with details of construction, and its line of centrifugal pumps for heads up to 250 feet with ratings and design.

CONVEYOR CHAINS — Link-Belt Co., Chicago, has published a 16-page illustrated book on its line of conveyor chains operating over cut tooth sprocket wheels. Dimensions, weights, ultimate strengths and list prices are given. Three pages are devoted to a tabulation of cut tooth sprocket wheels available for each size of chain.

MATERIAL HANDLING — Cleveland Crane & Engineering Co., Wickliffe, O., describes its overhead materials handling products in a recent bulletin. Construction features of the standard one-ton, hand-propelled crane and the two-ton, three phase, pushbutton, floor-controlled crane are given.

BELTING—E. F. Houghton & Co., 240 West Somerset street, Philadelphia, tells the story of the preparation of leather from steer to pulley, the relation of motor torque to belt stress, the effect of pulsating loads on belts, causes and cures of pitting of stainless steel by leather, etc., in a booklet called "Research Illustrated."

CONTROL INSTRUMENTS—Brown Instrument Co., Wayne and Roberts avenues, Philadelphia, has published data and features of its line of air operated control instruments. The units are said to be simple, compact, hermetically sealed and equipped with a graduated throttling range and automatic reset dials.

CUPOLA BLOWING — Ingersoll-Rand Co., New York, in a recent booklet, covers the application of its blower for cupola blowing, with particular emphasis on the supplying of a constant weight of air. In addition to the complete description of the blower and the automatic air-weight control mechanism, the bulletin contains an article on "Modern Theory and Practice in Cupola Blowing."

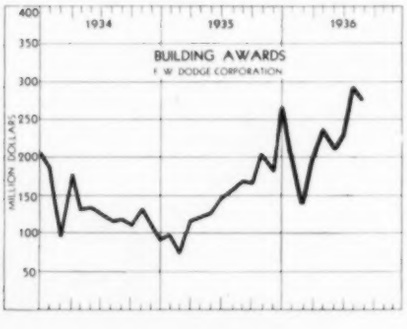
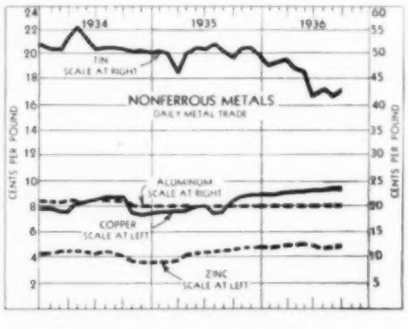
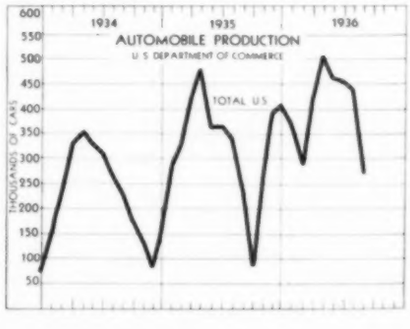
REFRACTORIES — Quigley Co., New York, describes its castable refractory of special appeal to engineers concerned with furnace operation and maintenance, in a recent folder. Handled like concrete, the product is recommended for casting special shapes in a short time, monolithic furnace linings, boiler door arches and jambs and domestic furnace door linings.

RESEARCH—General Motors Research division, Detroit, recently has published an interesting booklet entitled "Research —An Eye to the Future."

The booklet discusses in a popular style, the value of men in research work, and then develops certain research projects undertaken by General Motors Research division and resulting in definite applications to the automobile industry.

ALUMINUM — Fundamental information concerning various alloys of aluminum is presented in considerable detail in a recent booklet published by the Aluminum Co. of America, Gulf building, Pittsburgh, and entitled "Alcoa Aluminum and Its Alloys." Sections of the book are devoted to both cast alloys and wrought alloys. An appendix includes tables showing the physical properties, composition, typical mechanical properties, minimum mechanical properties, dimension tolerances, and available commercial sizes of the various aluminum alloys and aluminum alloy products.

TRANSFORMERS — Wagner Electric Corp., 6400 Plymouth avenue, St. Louis, has published two new transformer bulletins on distribution and power units. One contains 102 pages, discussing the characteristics, insulation, core and coil construction, tank design, accessories, testing, etc., of eight different kinds of transformers of ratings of 500 kva and below. The other booklet consists of 70 pages and discusses completely the assembly, construction features, installations, accessories, etc. of all types of single and three-phase transformers of ratings of 501 kva and above.

Faked Foundry Facts

Sand Cutter